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THE ECONOMICS AND ORGANIZATION OF CHEMICAL PRODUCTION

by S. Z. Pogostin

-USSR-

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## THE ECONOMICS AND ORGANIZATION OF CHEMICAL PRODUCTION

-USSR-

[Following is the translation of the book Ekonomika i Organizatsiya khimicheskogo proizvodstva (English version above), by S. Z. Pogostin, State Chemical Publishing House, Moscow, 1960, pages 1-247.]

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## INTRODUCTION TO THE FIRST EDITION

The national economy of our country is developing because of internal resources, that is, because of accumulation of material resources engendered by industry, transport and agriculture. The more efficient the socialist enterprises and the more products they manufacture, the more means has the State for further development of the national economy and strengthening of our country's power, and the demands of the population are satisfied far better.

The most important sources of our wealth are the increased labor productivity and lowering of the costs of production.

The increasing labor productivity and lowered production costs promote socialist competition and a popularization of progressive methods. Competing with one another, workers achieve better results, produce more better quality goods and economize on raw materials.

The workers of chemical industries are also increasing labor productivity. Through the persistent mastery of new techniques and technologies and efficient work scheduling, they fulfill and exceed State plans, save on raw materials and electric power, lower production cost and at the same time contribute to the accumulation of the stock pile.

Experience has shown that the greater the workers' economic knowledge and the more they attempt to grasp the economics of production, the more possibilities will they find for further increase in labor productivity, economy of the funds available, and increasing production output while lowering its cost.

This book sets forth information basically pertinent to economics and organization of the chemical industry. The limited size of this book does not permit the inclusion of all the variety of technological processes in chemical production and specific forms and methods for the organization of its labor force. The book adduces only the more specific examples relating to the manufacture of individual chemical products. In presenting this material to audiences engaged in any one of the particular branches of the chemical industry, instructors should provide supplementary material applicable to their particular branch.

The author will be grateful for any comments made regarding the contents of this book.

February 1955

Author

## INTRODUCTION TO THE SECOND EDITION

Since the publication of the first edition of this book, the chemical industry has achieved significant development, its industrial management has undergone changes, and the workers of the chemical industry have been placed on a shorter work day with new methods of pay for their labor.

Even greater perspectives opened before the chemical industry after the May (1958) Plenum of the Ts KPSS (Tsentral'nyy Komitet Kommunisticheskoy Partii Sovetskogo Soyuza -- Central Committee of the Communist Party of the Soviet Union), which indicated the necessity for accelerating the development of technical progress in the entire national economy, for further development of heavy industry, and increases in the production of consumer goods.

The ratified scheduled figures of the XXI Congress of the Communist Party of the Soviet Union for the development of the national economy of the USSR for the years from 1959 to 1965 forecast an approximately threefold increase in the general volume of production for the chemical industry, which includes a more than seven-fold increase in plastics and synthetic resins; an approximately threefold increase in mineral fertilizers; and an approximate four-fold increase in artificial fibers.

In order to fulfill this tremendous program, all workers in the chemical industry must know well the economics and organization of production to be able to, utilize fully all the reserves of production, to improve work scheduling and workers' earnings, to increase labor productivity and reduce production costs.

In line with these new goals set before the chemical industry, all the chapters in the second edition of this book have been re-edited and rewritten. The chapter entitled "Production Schedule of the Enterprise" (written by L. B. Levitan) has been considerably expanded and new chapters entitled "Wage Scale of Technical Personnel" and "Work Period Routine and Work Schedules" have been included.

All standard time-norms, as well as the production indicators, adduced in this book, and other analogous data, are arbitrary and serve as material to illustrate the method described.

Author

## Chapter One

### THE DEVELOPMENT OF THE CHEMICAL INDUSTRY

#### 1. The Significance of the Chemical Industry in the Development of the National Economy

The modern chemical industry yearly acquires greater significance in the general development of the country's economic structure and in every branch of the national economy.

The development of the chemical industry plays a most important role in the technical progress and rapid growth of the material and cultural welfare of the Soviet people.

There is no branch of industry which does not use, to some extent, one of the basic chemical products -- sulfuric acid. Major users of sulfuric acid are chemical plants producing mineral fertilizers. Sulfuric acid is used in the textile, oil, metallurgical, leather, and paper industries. A considerable amount of sulfuric acid is used in the production of pharmaceutical preparation, as well as in the manufacture of dyes and artificial fiber (figure 1).

Another chemical product -- soda ash -- is widely used in the manufacture of many chemical substances, soap and glass, and in the oil, metallurgical, textile, leather, cellulose, food, and paper industries.

Enterprises in the chemical industry manufacture tires and various rubber articles, plastic goods, lacquers and paints, and also many other materials widely used in machine building, electrical-equipment manufacture, construction, etc.

The chemical industry at the present time produces more than 2,000 articles made from thermosetting plastics and their number is growing constantly. The application of thermosetting plastics in engineering and daily use is very effective and economically feasible. Because of their physicochemical properties (low specific gravity, high tensile strength and chemical stability, non-conductive qualities etc.) many plastics are superior to metals, wood or other materials. Because of this, metal and wood accessories and component parts are being replaced in increasing numbers by thermo-setting plastic products in the machine-building and instrument-making industry, aviation and ship-building, electric equipment manufacture and other branches of industry as well as in transport industry. The automobile industry, for example, uses more than 350, and the electric equipment manufacturers more than 200 types of articles made from plastic. Nearly half of all thermosetting plastics now produced are used in machine building.

Various plastics are finding wider application in the building trade as materials for floors, walls or parts of buildings and as moisture, sound and heat insulating materials, and also in the manufacture of plumbing and sanitary-equipment and in decorative finishes for buildings.

Plastic is widely used in the manufacture of articles used in

daily life (radio and television cabinets, dishes, haberdashery goods, packing materials, etc.).

As a result of the use of thermosetting plastics, a considerable economy of metals has been achieved (every ton of plastic replaces four to five tons of steel or close to three tons of non-ferrous metals). The manufacturing process is simplified, the weight of the article is reduced and its cost is lowered.

The manufacture of chemical fibers is a relatively new branch of the chemical industry.

Chemical fibers have great significance in technology and are a new form of raw material for the manufacture of consumer goods. They are distinctive in their great durability, are not subjected to rot and corrosion, highly resistant to the effects of light and atmospheric conditions. Synthetic fibers (caprone, nylon, enanth, lavsan, and others) can be used in the manufacture of durable, cheap and attractive fabrics, knitted and fur goods.

Synthetic fibers are used in the manufacture of cord, indispensable in the manufacture of automobile and airplane tires, conveyor belts and belt-drives; fish nets and tackle, industrial cloth fabric, etc. The life of a tire has been increased sharply as a result of the use of cord made from chemical fibers.

The chemical industry produces many different forms of synthetic rubber, dyes for various textiles and also for leather and furs.

The production of mineral fertilizers is increasing with every year to satisfy the needs of the country's socialist agriculture (table 1).

By introducing mineral fertilizers into the soil, containing nitrogen, phosphorus, potassium, crops are greatly increased and harvesting time is shortened. The use of one ton of nitrates results in an average increase of 12 - 25 tons of winter wheat, 120 tons of potatoes, 120 - 160 tons of sugar beets. One ton of phosphorous pentoxide increases the harvest of winter wheat by 7 - 8 tons, potatoes 40 - 50 tons, sugar beets by 50 - 55 tons.

To combat pests and diseases of plant cultures, weeds, and also for the protection of the collected harvest, the chemical industry produces various chemical weed and pest killers -- barium chloride, granozan, calcium arsenate, chloropicrin, hexachlorine, DDT and others.

As a result of the application of chemical weed and pest killers in agriculture, the country saves millions of tons of grain, vegetables and fruits. The development of the manufacture of synthetic products made by utilizing hydrocarbon gases resulting from the processing of petroleum, natural gases, gases that are by-products of oil drilling, and various types of crude oil, and also from chemical processing of wood, has great importance for the protection of grain and potatoes.

On the basis of the wide utilization of non-edible forms of raw materials, the chemical industry increases the production of such technical products as alcohol, industrial greases, detergents and others, upon which, earlier, a considerable amount of farm-produced raw materials had been expended.

In 1955 alone more than two million tons of grain and more than 700 thousand tons of sugar beet were used in the processing of ethyl alcohol.

Four hundred thousand tons of edible fats are used in the manufacture of soap, detergents, drying oil, and grease. Three hundred thousand tons of vegetable oils were used in 1955 in the manufacture of soap alone. It has been estimated that in order to obtain this quantity of vegetable oil it is necessary to plant and harvest sunflowers in an area of 1.5 million hectares.

Chemical processes in the USSR penetrate into all branches of the national economy. Soviet science and engineering create new types of chemical materials and work out new technological methods for their manufacture. The chemicalization of agriculture, the broad application of chemical methods in the food industry, the increase in the manufacture of synthetic materials are all powerful factors in the cause of creating an abundance of products in our country and in the preparation of material conditions for Soviet society's transition to communism.

Table 1

Production of mineral fertilizers during 1913-1955 (in thous. of tons.). ([Note:] Industry of the USSR, A Statistical Summary, Gosstatizdat [State Statistical Publishers], 1957, page 192.

| Years | Total quantity of mineral fertilizers | Including   |  |   |   |
|-------|---------------------------------------|---|--|---|---|
|       |                                       | Nitrogen fertilizer (when converted to ammonium sulphate) | Phosphate fertilizer (when converted to 18.7% P O <sub>4</sub> ) | Potash fertilizer (when converted to 41.6% K O) | Phosphorus dust (when converted to 19% P O <sub>4</sub> ) |
| 1913  | 89.0                                  | 13.8  | 67.3   | --  | 7.9   |
| 1928  | 135.4                                 | 11.2  | 111.5  | --  | 12.7  |
| 1932  | 920.8                                 | 55.6  | 478.7  | 1.9   | 384.6   |
| 1937  | 3340.0                                | 761.6   | 1472.7   | 355.8   | 649.9   |
| 1940  | 3237.6                                | 971.7   | 1351.9   | 532.3   | 381.7   |
| 1950  | 5492.4                                | 1908.3  | 2350.5   | 750.4   | 483.2   |
| 1955  | 9640.0                                | 2984.0  | 3833.7   | 1898.3  | 924.0   |

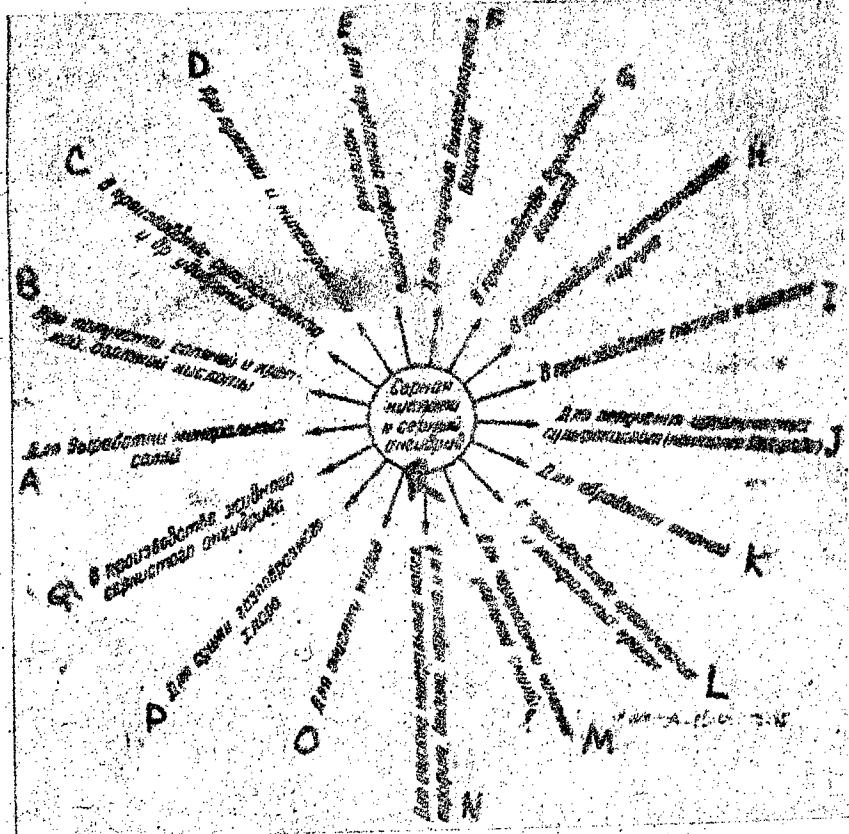


Fig. 1. Application of sulfuric acid and sulfurous anhydride in industry.

Legend:

- A. For the production of mineral salts;
- B. Derivative of hydrochloric and strong nitric acids;
- C. In the production of superphosphates and other fertilizers;
- D. In tinning and nickelplating;
- E. For etching metal surfaces;
- F. To extract smoke-generated matter;
- G. In the production of explosives;
- H. In the production of synthetic rubber;
- I. In the production of syrup and glucose;
- J. To extract organic sulf-acids (Petrov's contact);
- K. For the production of fibers;
- L. In the production of organic and mineral dyes;

- M. For the production of rock-coal resins;
- N. For the purification of mineral oils, paraffin, benzine and others;
- O. For the purification of greases;
- P. For dehydrating gaseous chlorine;
- Q. In the production of liquid sulfurous anhydride;
- R. Sulfuric acid and sulfurous anhydride.

## 2. The Chemical Industry in Pre-Revolutionary Russia

Trades such as salt extraction, tar extraction, production of potash, gunpowder, nitrate and others had been developed in Russia a long time ago. Russia in the XVIIth century occupied one of the first places in the world in the production of potash, products resulting from the chemical processing of wood (resin, tar) and in the production of fish glue. These products not only satisfied the internal demands of the country, but were also exported to countries in Western Europe.

The manufacture of many chemical products in Russia began earlier than in other countries of the world. Thus, the extraction of sulfur from pyrites in Russia began in the middle of the XVIIIth century, that is, considerably earlier than in Sweden. The first sulfuric-acid plant in Russia was built in 1805, earlier than in Germany. The production of soda by the ammonia method appeared in Russia in 1869, that is, a year earlier than in Germany.

The first sodium-bichromite plant was built in Russia in 1850, which in volume of production had no equal in Europe. Part of its production in the first years of its existence was even sent abroad.

The world's first oil well of commercial significance was drilled in Russia at Bibi-Eybat in 1848 and at Ukhta in 1855.

An oil refinery for the production of kerosene was built in Surakhany (near Baku) in 1859.

Up to the end of the XIXth century no use had been found for benzine and it was burned up as waste matter in special furnaces or dumped into the sea. Mazout (black oil) began to be used as fuel for boilers only after the invention of the oil burner by V.G. Shukhov at the end of the XIXth century.

Russian chemist D.I. Mendeleyev in the seventies of the last century indicated the impropriety of using oil only as a fuel and the possibility of using mazout as a lubricant. With his participation and assistance, lubricating oils were produced in Russia in 1876.

The successful utilization of electric power in the chemical industry contributed in many respects to the work of Russian scientists and engineers.

One of the first electrical and chemical engineers was Russian academician V.V. Petrov (1762-1834). In 1802 he built the most powerful battery of its time in the world out of 2,100 copper and zinc plates and adapted it to a continuous electrolysis of water, oxydation of mercury and other matter.

In 1888, D.A. Lachinov designed and built the world's first installation for the electrolysis of water under pressure.

The outstanding achievements of Russian scientists in the field of electro-chemistry did not find applications in Russia and were not properly evaluated by the tsarist government. Most of the Russian inventions in this field were used abroad. This is explained by the fact that the general development of electro-chemical production is tied to the availability of considerable amounts of electric energy, and that

pre-revolutionary Russia was one of the world's smallest producers of electric power.

The first experiments in the use of mineral fertilizers in Russia took place toward the middle of the XVIIIth century. However, geological explorations for phosphorite deposits were begun only in the sixth decade of the XIXth century, at which time they were not developed as much as they deserved.

The first plant for the production of superphosphate in Russia began to operate in 1868 in Kovno (now Kaunas, Lithuanian SSR).

In that same year, D.I.Mendeleyev proposed the organization of systematic experiments for the application of fertilizers under various soil and climatic conditions, according to a detailed plan worked out by him. These experiments were the beginning of a great project which unfolded in our country only after the victory of the Great October Socialist Revolution.

In 1908, professor D.N.Pryanishnikov began systematic experiments for chemical processing of native phosphorites into the superphosphates and concentrated fertilizers.

In spite of the important scientific discoveries in the chemical field and the vast resources of chemical raw materials, the chemical industry in tsarist Russia developed very slowly and was one of the least developed branches of the economy.

Pre-revolutionary Russia produced: aniline dye, one-thirtieth of Germany's production; superphosphate, one-fiftieth of the production in the USA and one-thirtieth of that of France; sulfuric acid, nearly one-ninth of England's production.

The greatest mineral wealth of the country was explored very weakly and unsystematically.

With huge, practically untouched resources of raw chemicals available, the chemical industry in tsarist Russia worked basically with imported raw materials. Phosphorite was mostly imported from Africa; pyrites from Spain; sulfur from Italy; potassium salt, intermediate products for dyes and the larger part of the dyes themselves from Germany. So that in 1913, the following raw materials and products were imported (in thousands of tons):

|                   |       |                 |      |
|-------------------|-------|-----------------|------|
| Sulfurous pyrites | 146.6 | Potassium salts | 77.0 |
| Superphosphate    | 196.7 | White lead      | 2.0  |
| Chalk in bulk     | 116.0 | White zinc      | 3.0  |
| Sodium nitrate    | 43.4  | Rubber          | 12.8 |

The development of the chemical industry was also handicapped by the absence in Russia of machine works for building of chemical machinery and equipment; reactors, centrifuges, vacuum pumps, special vessels, etc. Although Russia was the first in the world in platinum mining, the equipment necessary for the concentration of sulfuric acid, processed with the use of Russian platinum, was imported from abroad.

The major companies in the chemical industry in Russia were in the hands of foreign capital -- German, Belgian, French, and English. The technical personnel of many chemical companies also consisted of foreigners, although the country had highly qualified Russian engineers.

The large Treugol'nik ("Triangle") factory was under the authority of a Russian-American Joint Stock Company; the aniline-dye and chemico-pharmaceutical companies belonged to German owners; the lacquer-dye plants, to French industrialists.

Foreign firms held back the development of the chemical industry in Russia. They invested their capital only in those production fields that brought them the greatest return. A large quantity of chemical products and goods was manufactured out of intermediate products imported from abroad. The satisfaction of Russia's demands, for example, for medical products, depended upon imports of intermediate and finished products, mainly from Germany.

Working conditions for employees in the chemical industry in pre-revolutionary Russia were very difficult.

In spite of the detrimental environments in the chemical industry, the work day at chemical plants continued close to twelve hours (there were two shifts) under completely unsatisfactory sanitary conditions.

The governor of Moscow reported to the Tsar: "Hygienic conditions in the factories are of a nature injurious to the health and lives of the workers: absence of proper ventilation contributes to the development of tuberculosis and other diseases; sleeping and eating on the premises where products injurious to health of the workers are manufactured, and the poor quality of food which slowly weakens his strength, and gradually destroys his health, decisively and prematurely leading him to his grave" ([Note: V.P.Litvinov-Falinskiy, Factory Legislation and Factory Inspection in Russia, second edition, published 1904]).

The working conditions in the manufacture of rubber footwear are described by B.I.Shabalov in his book "Factory on Obvodnyy Canal" devoted to the history of the Treugol'nik rubber factory.

For both adults and children, the work day lasted  $11\frac{1}{2}$  hours (from six o'clock in the morning to seven at night with a half-hour break for breakfast and a one-hour break for lunch). They worked in a dirty building filled with benzine fumes, using heavy cast-iron forms. They assembled rubber footwear in standing position. Women engaged in this back-breaking work rapidly lost their strength and turned into invalids in several years.

Despite the excessive length of the work day and difficult working conditions, workers' wages were very low.

V.I.Lenin in his article Workers' Earnings and Income of Capitalists in Russia indicated that two and quarter million proletariat of Russia in 1908 earned 20 roubles and 50 kopeks each month, or 246 roubles a year. At the same time each worker, on the average, earned 252 roubles per year in profits for the capitalist ([Note: V.I.Lenin, Works [in bibliography], volume 18, pages 232-233]).

In 1913, the average earnings of the workers in the chemical industry in Russia were 313 roubles a year or 11.2 kopeks an hour. The owners of the chemical factories received a huge profit. The

Russian-American Rubber Manufacturers, for example, received a profit of more than three million roubles in the years 1896-1897, which represented an income of 70% on the invested capital.

Poor wages were cut down even further by the capitalists with the aid of fines. In 1904, 2,903,172 fines imposed on workers were recorded (231 fines per 100 workers) ([Note:] K. Pazhitnov, Conditions of the Working Class in Russia on the Eve of the Revolution of 1905-1907, "Economic Issues", No 5, 1955). Fines were imposed for various reasons (in %):

|                          |      |
|--------------------------|------|
| For "defective" work     | 74.3 |
| For absenteeism          | 14.3 |
| For "violation of order" | 11.4 |

The use of physical punishment against the workers must be cited as a typical working condition.

Low wages, which did not provide for the minimum of material and cultural needs of the worker and his family, difficult working and general living conditions gave rise to a growing organized resistance to the exploiters on the part of the workers. Despite police and judicial repressions, the strike movement was spreading. In 1913, 62 strikes, in which 45,000 persons participated, took place at chemical plants.

These strikes, generated due to the daily disputes between worker and capitalistic interests, under the leadership of the Bolsheviks, outgrew their narrow economic frame and turned into the means with which the working class battled the tsarist system.

### 3. Development of the Chemical Industry During the Years of Soviet Regime.

As a result of the victory of the Great October Socialist Revolution, unlimited opportunities opened up in the country for the development of all branches of the national economy, including the chemical industry.

In those first days after the October Revolution, the Communist Party and the Soviet government set the task for the establishment in the country of a strong chemical industry, capable of satisfying the demands of the national economy and the population for all varieties of products of chemical manufacture.

In 1918, V.I.Lenin wrote: "An upgrading of workers' productivity requires, before all else, the provision of a material basis for heavy industry -- the increase in the production of fuel, iron, machine-building and chemical industries." ([Note:] V.I.Lenin, Works [in bibliography], volume 27, page 228).

The Soviet government adopted a series of legislative measures in the field of labor protection and industrial safety for the radical improvement of working conditions in the chemical industry. Besides this, a shorter work day, special preventive and health diets, extra vacation time, special work clothes, etc., were provided for a number of occupations.

The legacy inherited by the Soviet national economy from the Russian pre-revolutionary chemical industry was very modest. In 1913 Russia counted 70 chemical enterprises, with obsolete technical methods. During the years of the imperialistic and civil wars more than 30% of the chemical plants were put out of operation, and most of the basic machinery of the plants in the chemical industry became worn out, and the manufacture of chemical products was reduced drastically.

Owing to the measures adopted by the Communist Party and the Soviet government, the chemical industry, by 1925, was re-established and the output of chemical production reached the 1913 level. After this began the reconstruction and expansion of the old industries and the building of new ones. At the same time, in order to establish our own raw material stock-pile, extensive geological explorations were initiated in various parts of the country.

Large deposits of potassium salts were discovered in the Solikamskiy Rayon in 1926 and drilling as well as working began on a large scale. Also, the construction of the first large potassium mine was started. Later, on the Kol'skiy Poluostrov, large deposits of apatites and other minerals were discovered.

On the basis of raw materials found on Kol'skiy Poluostrov in the Polar Region, a large Khibinskiy Kombinat (Combine) was established, which processes, together with flotation concentrates, nephelinic concentrates and other kinds of valuable raw materials for superphosphate fertilizer plants.

Large chemical kombinats were built (combining as one enterprise various activities of technologically related functions) during the years of the first Five-Year Plan of 1928-1932 at Berezhnikov, Gorlov, Stalinogorsk, Voskresensk, Nevsk, Konstantinov, and other locations.

Toward the end of the first Five-Year Plan the capacity of the individual plants in the sulfuric-acid industry surpassed the 1913 level by nearly five times. New production branches were created in the chemical industry -- synthetic ammonia, plastics, artificial fibers, organic solvents. A radical reorganization in the essentially new anilino-dye industry, with its own raw material resources, was effected. Output of soda plants and factories in the lacquer-dye industry were doubled. Production of mineral salts and many other chemical products increased considerably.

The greatest achievement in the chemical industry was the establishment of synthetic-rubber production, the first in the world, made from ethyl alcohol by the method of academician S.V. Lebedev. Three plants as far back as 1932-1933 began to produce synthetic rubber.

In the following years, the chemical industry continued to develop at a rapid pace.

During the years of the second Five-Year Plan (1933-1937) new plants and factories were created in the chemical industry in the republics of the Union -- Armenian SSR, Kazakh SSR, Kirgiz SSR, where previously there had not been any chemical industry at all, based on the availability of power supply and raw material resources. The reconstruction and expansion of existing facilities were also continued.

The development of the chemical industry during the first two Five-Year Plans played a big role in the industrialization of the USSR, which was directed, in the first place toward the development of basic branches of heavy industry.

The third Five-Year Plan (1938-1942), adopted by the XVIII Congress of the party, set the goal to convert chemical industry into one of the leading branches, satisfying the demands of the national economy and the national defense. The Congress resolved to increase the output of the chemical industry by 2.4 times, concurrent with a 92% growth in all industry.

Special significance was attached by the third Five-Year Plan to further increase in the production of mineral fertilizers, plastics and rubber.

As a result of putting new plants and factories into operation and the reconstruction of existing ones, the output of the most important types of chemical production in 1940 (compared with the 1913 output) has increased as follows: sulfuric acid 17 times; superphosphate 66 times; caustic soda 4 times, and dyes 3.3 times.

The fulfillment of the third Five-Year Plan was interrupted as a result of the treacherous attack on our country by the German Fascist aggressors.

Under the difficult conditions of the second World War the chemical industry successfully rebuilt its operations and in spite of the hardships, aggravated by the temporary occupation of a number of important areas of the country, assured the output of products for the supply of the front and for meeting the demands of primary needs of the national economy.

During the first post-war Five-Year Plan (1946-1950) the chemical industry was faced with the task, as was the entire national economy of the USSR, of completely rebuilding the destroyed plants and factories and assuring the production output for the satisfaction of the country's growing demands.

Mass socialist competition for the rapid rehabilitation of the national economy favoured the fulfillment of the post-war Five-Year Plan ahead of schedule. During the years of the fourth Five-Year Plan not only were the chemical plants and factories, destroyed in the war, fully rehabilitated, but a number of new plants were built.

In 1950, the output of chemical production surpassed the level of 1940 production 1.8 times. The pre-war production level of nitrogen fertilizers was increased 2.2 times, phosphates 1.9 times, potassium 1.4 times, and plastic 1.2 times.

The output of dyes in 1950 reached 320 varieties instead of the 186 varieties in 1940.

The development of the chemical industry was promoted by the introduction of new methods and technological processes into production, by the perfection of scientific methods (high pressure engineering, high vacuum machinery, high-temperature apparatuses, electro-chemical processes and automation.) The number of workers in the chemical industry grew considerably and their qualifications improved. The number of technical personnel and chemists increased. New scientific-research institutes and laboratories were built.

During the years of the fifth Five-Year Plan (1951-1955) the chemical industry was faced with new responsibilities to assure the high rate of increase in the production of mineral fertilizers, soda and synthetic rubber (mainly on the basis of utilizing petroleum gases), increase the output of plastics, dyes and raw materials for artificial silk, and increase the assortment of other chemical products.

With the development of the chemical industry, the fifth Five-Year Plan provided for an increase of 88% in the production of mineral fertilizers, compared with the actual levels achieved by the 1950 output, an increase of 84% in soda ash, and 82% in synthetic rubber.

The chemical industry of the USSR, in its fifth Five-Year Plan (concurrent with the Plan of national economy) continued to develop at a somewhat faster rate than the entire industrial production of the country. Thus, the production output of the entire industry in 1955, as compared to 1950, amounted to 185%; heavy industry at 191%, but the chemical industry at more than 200%. In terms of production volume, the chemical industry in the last year of this Five-Year Plan exceeded the Plan's goal by 113%. Scheduled chemical production for the end of the Five-Year Plan was achieved in four years and three months. Below are adduced data of the increase in output of the most important types of chemical products in 1955 as compared to 1950 (in %) (The Chemical Industry, No 7, 4, 1957).

|               |       |                     |       |
|---------------|-------|---------------------|-------|
| Sulfuric acid | 178.7 | Mineral fertilizers | 175.5 |
| Ammonia       | 168.2 | Synthetic rubber    | 168.5 |
| Soda Ash      | 191.9 | Automobile tires    | 137.7 |
| Caustic soda  | 173.5 | Plastics            | 228.0 |

In 1955 the USSR lead Italy, France and England in the production of sulfuric acid, superphosphate, phosphorite fertilizer, soda ash, and insecticides (DDT and GKhtsG - hexachlorocyclohexane).

In 1940, the USSR occupied fourth place in the world's production of sulfuric acid, but in 1955 came up to second place (after the USA).

The chemical industry, in the fifth Five-Year Plan, organized the production of new types of plastics, new varieties of durable dyes, synthetic ethyl alcohol, etc.

Despite the high level of achievement in the production of chemical products the needs of the national economy for some types of these products were not met. For this reason the XX Congress of the CPSU (Kommunisticheskaya Partiya Sovetskogo Soyuza - Communist Party of the Soviet Union) provided for the further speed-up in the development of the country's chemical industry. Particular attention was paid to the increase in the output of mineral fertilizers by moving their production facilities close to sources of raw material and to areas using their products; to the extensive use of petroleum and natural gases, and also to petroleum products for the manufacture of synthetic materials and articles to meet population requirements and industrial needs; and to the introduction of synthetic raw materials instead of farm products which are used for technical purposes.

In 1956, the SK Synthetic Rubber Plant at Voronezh started the manufacture of oil-filled rubber (divinylstyrol rubber - butadiene rubber, filled with mineral oil). As a result of the output of this type of rubber, the factory was able to save a large quantity of alcohol in 1956.

Oil-filled rubber is 15-20% cheaper than the regular Butadiene rubber and possesses higher resistance to wear, being furthermore easier to work with; automobile tires made from it hold up better in use than do the ones made from natural rubber.

The same factory, in its production of synthetic rubber, has replaced stearic acid with a cheaper synthetic fatty acid which has considerably lowered the cost of rubber. This not only saves the factory almost a million rubles a year, but releases raw foodstuffs required to produce stearic acid.

In 1957, the country had an output of 11.7 million tons of mineral fertilizer; 1,613,000 tons of soda ash; 4,569 tons of sulfuric acid and monohydrate; 12.8 million automobile tires.

In 1958, as compared to 1957, the workers in the chemical industry increased their gross output production by 13% (Report of the Central Statistical Administration of the Soviet of Ministers of the USSR, dated 16 January 1959).

Furthermore, plans were completed ahead of schedule for the production of mineral fertilizers, rubber, automobile tires, caustic soda and soda ash, synthetic ammonia and sulfuric acid, synthetic resins and thermoplastics, artificial and synthetic fibers. The following were produced:

|  |      |
|--|------|
| Mineral fertilizers, mill. tons                    | 12.4 |
| Sulfuric acid, mill. tons                          | 4.8  |
| Ethyl alcohol, mill. decalitres                    | 163  |
| Artificial and synthetic fibers,<br>thousands tons | 166  |
| Automobile tires, millions                         | 14.4 |

#### 4. Main Goals in the Further Development of the Chemical Industry

Despite the creation of a strong chemical industry in the USSR and the fast rate of growth in the output of chemical products, the needs of the national economy for these products have not been completely satisfied.

The May (1958) Plenary Session of the CC (Tsentral'nyy Komitet - Central Committee) USSR, in an address by N. S. Khrushchev, indicated that in particular plastics, synthetic rubber, artificial and synthetic fibers, mineral fertilizers and several other types of chemical products, were manufactured in insufficient quantities. In conjunction with this, the Plenary Session of the CC USSR adopted a resolution to speed up the development of the chemical industry and particularly the production of synthetic materials and articles to satisfy consumers' demands and needs of the national economy.

The measures worked out by the Presidium of the CC USSR and the Soviet of Ministers of the USSR for accelerating the development of the chemical industry were reflected in the control figures related to the expansion of the national economy of the USSR in the period 1959-1965, ratified by the XXI Congress of the CPSU.

The control figures provide for an approximately three-fold increase in gross volume in the manufacture of chemical products toward the end of the Seven-Year Plan.

Especially rapid rates of development are scheduled for the production of synthetic materials which have an exceptionally important significance for the economic development of our country. The production of artificial fibers is scheduled to be increased four-fold, and the more important ones - synthetic fibers, by 12-13 times and plastics and synthetic resins more than seven times.

Production of synthetic rubber in general should be increased 3.7 times, and specific types of rubber many times more. The output of mineral fertilizers is scheduled to be increased from 12 million to 35 million tons.

The development of the chemical industry will involve an expenditure of 100-105 billion rubles, which includes more than 50 billion for the production of synthetic materials, or 2.5 times as much as that expended in the entire chemical industry during the last Five-Year Plan.

By 1965, based on the expansion of production of synthetic materials, it is intended to increase the planned outputs for the following:

|  |           |
|--|-----------|
| Woolen fabrics, mill. meters   | up to 500 |
| Silk fabrics, mill. meters   | " 1,485   |
| Cotton fabrics with the application of artificial and synthetic fibers, mill. meters | " 480     |
| Knitted wear, mill. pcs  | " 940     |
| Artificial astrakhan, mill. sq. meters   | " 5       |
| Footwear, mill. pairs  | " 515     |

To meet the demands of the automobile industry, the tractor and agricultural machine building, and also the automotive pool of the country during the years of the Seven-Year Plan, a considerable increase is scheduled for the production of automobile tires (their output in 1965 will be 29 million pieces). At the same time, tire construction should be improved and manufacturing processes perfected.

In connection with the increasing output of tires, production of carbon black, accelerants, regenerators, and other materials will be increased considerably.

The Seven-Year Plan provides for a 25-fold increase in the production of active carbon black in comparison to 1959.

New factories engaged in the production of synthetic fibers, plastics, synthetic rubber and other materials will be built mainly in areas with developed oil, oil refining and chemical industries, having the most needed and cheap raw materials -- oil and natural gas, coal-tar and gasotorfoslantsevyy (petroliferous shale) chemical products. These raw material resources are available in large quantities in the Russian Federation, Ukrainian SSR, Azerbaijan SSR, and Uzbek SSR.

The manufacture of organic synthesis products will be rapidly developed in the Ukrainian SSR base of the utilization of natural and by-product gases and wastes from coal-tar chemical industry. During the Seven-Year Plan three large chemical plants will be constructed, and construction is nearing completion of viscose and caprone fiber plants, a tire factory, sulfur kombinat and facilities of the potassium kombinat are also expanded.

Scheduled for construction in the Belorussian SSR are a potassium kombinat, superphosphate and nitrogen fertilizer plants, and a second superphosphate fertilizer plant. As a result of this, a large new base for the production of mineral fertilizers will be created in Western SSR.

Production of mineral fertilizers in the Uzbek SSR will be doubled in the course of the Seven-Year Plan and output of chemical fibers will increase considerably.

In the Kazakh SSR, production of artificial fibers will increase approximately ten-fold; output of mineral fertilizers will increase considerably, and production of synthetic rubber, automobile tires and caustic soda will be organized. Production of cellulose and cardboard is being organized using reed as a component.

Realization of further development in industry and technical progress of the country is connected with not only the perfection of industrial technology in chemical enterprises and with the establishment

of new branches in the chemical industry, but, to a great extent, with the introduction of chemical methods in all branches of the national economy with the goal of complex and efficient utilization of raw material and power supply resources.

The increase in the output of the chemical industry during the Seven-Year Plan should be realized by increasing the outputs of existing plants and also as a result of the construction of new ones. The expansion and intensification of existing plants, as a rule, permits a significantly faster increase in output with fewer expenditures, instead of building new facilities.

This goal can be achieved only as a result of systematic reconstruction of existing facilities, including all branches of the production complex; the replacement of obsolete equipment with that which is more efficient and improved; the introduction of new and effective technological processes; the broad application of most modern means of mechanization and automation in order to exclude completely the use of difficult labor.

In the production of sulfuric acid and soda ash, an advanced method such as the roasting of materials in a "fluidized bed" should find wide application. The roasting of sulfurous materials in a fluidized bed, accomplished at the Voskresenskiy chemical kombinat, will permit further intensification and automation of this process.

This method can also be applied for the roasting of carbonaceous raw materials mixed with coal in the production of soda ash.

At the present time the utilization of ore mass does not exceed 50%, because of the formation of a large amount of fines which cannot be processed in the existing mine furnaces. Roasting in the fluidized bed permits complete utilization of mined raw material for the production of high concentration lime and carbon dioxide. This method of roasting may turn out to be particularly effective with the application of oxygen-enriched air.

The government has granted the plants and factories the right to receive credits at the Gosbank (State Bank) in order to install measures for the introduction of new methods. However, the managers of individual plants and factories have not sufficiently availed themselves of these opportunities and in this way retard the improvement of technological processes as well as rise of the technical and economic indicators of the plant operations.

With the development of the chemical industry, particular attention should be paid to problems concerning the improvement of sanitary and health conditions, within shops as well as within the plant grounds. During the Five-Year Plan most of the plants had mechanized the process for the cooling and removal of cinders; open acid coolers have been replaced almost everywhere with closed-type coolers; packaging methods for a number of products have been mechanized, and a large number of other measures related to the improvement of sanitary and hygienic working conditions have been achieved.

However, in connection with the increase in the production rate of the chemical processes it is necessary to continue working toward

further hermetical sealing of the operating apparatus, mechanization of all labor-consuming processes, and detoxication of production gases and liquids, etc.

To provide adequate working conditions in production would be impossible without improvement in the full utilization of the equipment, or without an increase in technological and labor disciplines.

In the matter of improving working conditions, increasing workers' productivity and reducing waste of raw materials and finished products, the development of mechanized storage facilities, repair and auxiliary shops, as well as the elimination of existing disparity in some plants between their main production shops and their auxiliary services, are of great importance.

The main and decisive condition for the successful fulfillment of goals set before the industry is the overall increase in labor productivity. In the course of the Seven-Year Plan labor productivity is scheduled to be increased by 45-50%. This increase in labor productivity should bring about a 7.5% increase in production. Every percentage-point increase in labor productivity in the industry enables production output to rise by one billion rubles and concurrently decreases considerably the need for labor and achieves savings in the wage appropriation.

The chemical industry creates necessary conditions for the rapid growth in labor productivity. Plants and factories with new-type machinery, labor-consuming work is mechanized and processes are automated, workers' qualifications are raised, production management is better organized, and advanced production methods are introduced.

However, despite the general significant growth in labor productivity in the entire chemical industry, several plants and factories have not fulfilled their tasks with respect to increasing labor productivity because of unsatisfactory utilization of new methods and equipment and the insufficient use of modern production methods. As a result, these plants and factories permit over-expenditures of the wage fund and do not fulfill their goals for the decrease of their production costs and the accumulation of stock-pile.

The Central Committee of the CPSU and the Soviet of Ministers of the USSR have indicated that plant managers, in a number of instances, have reconciled themselves to the fact that the increase in labor productivity has not kept pace with the rise in wages, and have also indicated that local Party organizations and councils do not suppress this anti-State practice.

The CC CPSU and the Soviet of Ministers of the USSR have instructed the sovmarkhоз'ес (Councils of National Economy) to establish the required order in the expenditure of wage funds at these plants. Persons permitting an over-expenditure of the wage fund while attempting to meet production plans will be deprived of bonuses until they reimburse this over-expenditure.

The State Labor and Wage Committee of the Soviet of Ministers of the USSR and the VTSSPS (Vsesovuznyy Tsentral'nyy Soviet Professional'nykh Soyuzov - All-Union Central Council of Trade Unions) have listed the responsibilities of technical supervisors in industrial

enterprises, who will be deprived of their bonuses should they permit the over-expenditures of wage funds due to their own negligence.

This list includes: directors, their deputies and assistants; chief engineers and their deputies; department heads and their deputies; chief accountants and their deputies; shop superintendents and their deputies; personnel supervisors and production-schedule supervisors; shop accountants; chief machinists and chief electricians; foremen and leaders; persons in charge of services not directly connected with production and which do not operate on a separate budget (garages, housing and communal offices, repair shops, quarries, warehouses, supply offices, etc.).

The decrease in the amount of raw material used for a ton of finished product and better utilization of production wastes have a significant bearing on the increase of the output of chemical production and reduction of its cost. The utilization of production wastes in the chemical industry leads to a more complete use of raw materials and in many instances contributes to an improvement in working conditions.

Further increases in labor productivity and improvements in the technical and economic indicators of these enterprises depend largely on the staff personnel in the leading trades of the chemical industry. Systematically increasing their knowledge and production qualifications, the best of them strive for a strict observance of technological regimes, rational consumption of electric power, raw materials and supplies, high productive use of machinery and auxiliary equipment, thus contributing to the fulfillment and surpassing of production plans and to the improvement in the technical and economic indicators of production.

#### Economic Cooperation Between Socialist Countries

Further strengthening of economic ties between socialist countries will contribute to the rapid development of the chemical industry. At the XXI Congress of the CPSU, Premier N.S.Khrushchev said that "Not one country could have developed individually at such a rapid pace as within the system of socialist states."

The economic and scientific and technical cooperation between socialist countries is acquiring deeper characteristics. Advanced are the problems concerning cooperation and specialization of production, coordination of plans for development of national economics for extended periods. This insures the possibility of avoiding any parallelism and duplication in individual branches of industry and in the building of new plants and factories. It achieves economy of material resources and a more efficient utilization of natural wealth and economic facilities of socialist countries for stepping up the pace of their development.

As a result of international socialist division of labor and the strengthening of unity, cooperation and mutual aid, most of the people's democracies no longer find it necessary to create all

branches of industry within their own borders. The development of industrial forces in each of these countries assumes the form of specialization in the manufacture of those products for which they have the most favorable natural and economic resources. Thus, each socialist country considers itself an integral part of a universal socialist economic system.

Building of socialism in people's democracies is accomplished with the friendly assistance and support of the Soviet Union, which transfers to these countries, without compensation, licenses for new machines, devices, technological processes; carries out projects, installs complex equipment, renders assistance in the construction, assembly, adjustment and initiation of new enterprises. The Soviet Union, in turn, takes advantage of the experience of people's democracies and applies widely into practice their achievements in science and engineering.

Thus, toward the start of 1958, with the help of the Soviet Union, 500 industrial enterprises had been constructed or were being constructed in the socialist countries. In their turn, a number of the people's democracies supply the Soviet Union with complex equipment for sugar, cement, chemical and other industrial establishments. The socialist countries are building together various industrial factories and plants, using the same power resources; taking common measures in production and in the economy of ferrous and non-ferrous metals; specializing further in the production of machines and equipment; increasing the extraction of coking coal in the European people's democracies; examining closely the specialization and cooperation of the chemical industries, and so forth. The socialist countries cooperate between themselves through the means of a free-production zone.

The decision to build a pipeline from the USSR to Poland, GDR (German Democratic Republic), Czechoslovakia and Hungary has great significance for the international socialist division of labor.

Owing to close cooperation and mutual aid, the people's democracies have taken a tremendous leap in the development of their productive strength. Socialist industrialization of these countries has given rise to a rapid growth of their chemical industries and introduction of new chemical and technological processes into the various branches of their national economies.

## Chapter Two

### INDUSTRIAL MANAGEMENT IN THE CHEMICAL INDUSTRY

#### 1. Basic Principles of Industrial Management in Socialist Industry

The fundamentals of industrial management and principles of economic leadership in the socialist production were first scienti-

fically worked out and applied in practice during the building of socialism by V. I. Lenin, the founder of the Soviet state.

The following main principles are the basis of management in socialist industry: unity of political and economic leadership; organization of all activities in the enterprise in accordance with State Plans; one-man management, combined with the organized participation of workers in the production management; material interest in the development of production, introduction of cost accounting; proper selection and assignment of personnel and systematic performance control.

#### Unity of Political and Economic Leadership

The combination of political and economic functions is the most important principle in the management of socialist enterprises. The strength of economic successes depends upon the proper organization of the political function and the political function, in turn, must be directed toward fulfillment and surpassing of State Plans and goals.

The XX Congress of the CPSU condemned attempts to separate the political function from the economic function and demanded that Party organizations not separate the Party functions from the economic functions and lead the economic part firmly, with a knowledge of the industry.

No less harmful and improper are attempts of individual economic leaders to avoid group political work with people and to occupy themselves with production matter alone. In order to direct these properly, it is necessary to use the political approach in resolving economic problems. This means that resolving economic problems must be based on Party policies. Economic policies of the Party find their expression in the State Plans for the development of the country's economy. Consequently, every leader must provide for the unconditional fulfillment of the plan in his own sphere.

Leadership of socialist production is realized on the basis of a unified national economic plan, uniting all enterprises in all branches of the economy into a single whole, and determining the proportion and rate of their development.

#### One-Man Management

One-man management is one of the most important principles of organization in the management of socialist industry. V. I. Lenin gave considerable attention to the execution of the strictest one-man management in the administration of production.

One-man management means the subordination of the collective body of workers to the leader, who has complete authority for the management of the sphere of work entrusted to him and who carries full responsibility for this sphere. One-man management excludes

undefined responsibility and irresponsibility. Every worker answers for his own sphere of work and is responsible to some particular person.

One-man management assumes the broad involvement of workers and employees in discussions of basic production problems. The decree of the Council of Ministers of the USSR of 9 August 1955 concerning "Broadening of authority of the directors of enterprises" indicates that in their area of operations the directors of enterprises should be supported by the active Party members of the enterprise with whom they should conduct production meetings and economic activities, where future plans and other important production problems could be discussed together.

One of the more effective forms of worker participation in production management is their active participation at the production meetings. Business criticism and self-criticism, clearing up of production troubles and discussion of workers suggestions at production meetings, shop and factory rallies, all help in the fast overcoming of deficiencies in their work, in the perfection of production processes, and in the fulfillment of production programs.

#### Material Interest in the Development of Production, and Introduction of Cost Accounting

Cost accounting is the method for planned industrial management of socialist enterprises, which method assures the more proper conduct of the internal economy and promotes the execution of the strictest economy regime in all spheres of production.

Every enterprise bears material responsibility for results of its economic activity. Working on a self-supporting basis, the enterprises must absorb all production expenses and assure the accumulation of planned stock-piles. Cost accounting forces plant managers to consider production expenses, to expend plant resources economically, to seek out and utilize internal reserves, and systematically to improve methods of production.

Cost accounting further assumes material responsibility of the plant in relation to other enterprises and economic organizations for the fulfillment of its obligations.

Economic interrelationships between the enterprises are regulated with the assistance of economic agreements. Enterprises, in accordance with general State Plans, acquire necessary resources for the production and accomplish their manufacture according to such agreements.

One of the most important requirements of cost accounting is the strict adherence to agreement between enterprises.

An important aspect of cost accounting is the material interest of the collective body in improving the accomplishments of their activities. Those plants and factories which fulfill their goals in the production output commensurate with quality and assortment of

products, and also lower their cost and build up an inventory, create the fund of the enterprise. Half of this fund's resources is expended in the improvement of workers' cultural and general demands as well as in rewards for outstanding workers, and the other half is used for housing construction, the introduction of new equipment and expansion of production facilities.

This fund is expended by the director of the enterprise in agreement with the plant trade-union organization.

Furthermore, the better-producing enterprises, recognized as winners in socialist competition between enterprises in the Sovnarkhoz (Sovetskoye Narodnoye Khozyaystvo - Soviet National Economy) receive a daily bonus. At least 50% of this sum is used to pay premiums to individual workers, another part of these monies is directed toward the payment of premiums to technical personnel, and approximately 30-40% is expended for the improvement of living conditions and cultural and general needs.

In this fashion, the system of cost accounting stimulates the observance of an economy regime by all production phases at a plant.

#### Correct Selection and Assignment of Personnel and Systematic Performance Control

To assure proper management of the plant it is necessary to select qualified personnel and assign them accordingly, to determine the position, authority and obligations of each worker in the production process. V. I. Lenin indicated that the most important factor in organized work is the ability to select and properly assign people and to conduct effective control over their performance. During the years of Soviet government, the Party developed many thousands of talented production organizers and specialists from among the people, qualified to manage the enterprises. In 1959, the number of technical personnel in the chemical industry increased considerably.

Proper work with technical personnel demands the organization of accurate control over their work -- a systematic control over the fulfillment of directives from higher economic agencies and their own decisions.

Control over the fulfillment of directives and instructions from the plant and shop managers increases workers' responsibilities for the work assigned to them and contributes to the improvement of activities in the spheres of production.

Control should be systematic and comprehensive. Absence of these controls leads to irresponsibility and bureaucratic methods of management.

Controls and checks on fulfillment of the program in Soviet enterprises are not only originated from above, through administrative channels, but also from below -- by the workers.

## 2. Management Reorganization in Industry and Construction. Chemical Industry Administration.

The problems of industrial management have always been the center of attention for the Party and the Government. Forms and methods of management have been constantly perfected. In this respect, the Party and Government have been selecting the more rational, more effective forms of management in some specific instances, which has insured further rapid growth of production and improvement in technical and economic indicators of plant operations.

The first stage in the economic building of our country for the management of the nationalized enterprises was the establishment of the Supreme Council of the National Economy (VSNKh - Vyshiy Soviet Narodnogo Khozyaystva), under the Soviet of People's Commissars, and on the local level -- the sovarkhоз'es.

New forms of economic management were called in for the newly-necessitated creation of new branches of industry within a short time, with the realization of the country's industrialization program which followed the resolution of tasks of the reconstruction period. Narkomats (People's Commissariats) were formed specializing in their individual branches, and subsequently the Ministries.

Departments of Commerce in the ministries have played their positive role in the national economy. They permitted the concentration of efforts in the establishment of key branches of heavy industry, in the training of necessary technical personnel and production experts.

However, the application of this form of management, concurrent with the unprecedented growth in the production scale and its high technical level, created hindrances in the path of further rapid industrial development.

Over 200 thousand State industrial enterprises and over 100 thousand construction projects are to be found within the territory of the USSR. Obviously, it would be very difficult for the Ministries to effect rigid and operational management of this huge number of enterprises. The vertical management of production from the center (The Ministries) engendered many deficiencies: departmental division and disunity; slow resolution of important problems due to the necessity for them to go through many stages and departments; limited use of materials and technical resources; diversion of a great number of technical personnel from direct participation in production, etc. The necessity became urgent to create a more flexible method of management of the national economy, which would give even greater scope to the development of the country's productive strength.

As a consequence of the above, the seventh session of the Supreme Soviet of the USSR, in accordance with an address by N. S. Khrushchev, adopted (10 May 1957) a Statute "For the further perfection of management organization in industry and construction."

According to this statute, industrial management must be effected on the territorial principle, based on economic areas. The Soviet of Ministers in each Republic of the Union will create a Council of the National Economy in each economic administrative area.

At the present time, 104 Councils of the National Economy have been formed within the territory of the USSR, and are managing directly enterprises situated in the territories corresponding to the economic administrative area. Special managements have been organized for the administration of individual branches of industry in the sov-narkhoz'es. Thus, for instance, chemical plants and factories located in Moscow are subordinated to the Management of the Chemical Industry of the Council of the National Economy, Moscow Municipal Economic Administrative Region. Enterprises in the chemical industry situated in Dzerzhinsk are subordinated to the Management of the Chemical and Oil Refining Industry of the Gorky Economic Administrative Region.

To provide for the general development and execution of proper technical ideas in the chemical industry, irrespective of the territorial distribution of chemical enterprises according to economic regions, the State Committee for Chemistry of the Soviet of Ministers of the USSR has been formed.

The Committee effects technical and economic exploitation of development problems in the chemical industry; determines the effectiveness of application of chemical production to the national economy; and provides engineering design for the plants and factories in the chemical industry now being constructed or being rebuilt.

The State Committee for Chemistry of the Soviet of Ministers of the USSR develops plans for scientific-research projects, for design and experimental work, as well as technical requirements for the production of chemical raw materials. The Committee renders technical assistance to the sov-narkhoz'es in the initiation and establishment of production in the newly built plants of the chemical industry.

The Committee is broadening and strengthening the economic ties and scientific-research cooperation in the chemical field between the Soviet Union and socialist, as well as other, countries abroad. It is studying the achievements of Soviet and foreign sciences and engineering and also the advanced operational experiments of enterprises in the chemical industry, publishes educational, scientific-research and technical-economic literature related to the problems of chemistry and chemical industry.

Directly responsible to the Committee are pilot plants, scientific-research chemical institutes and engineering organizations, independent of their territorial location. For the administration of these enterprises and organizations, the Committee has the following Boards (Administrations): synthetic rubber and oil chemistry; for the processing of natural gas and nitrogen; chemical fibers; plastics and synthetic resins; tires and rubber products; basic chemistry and chemical raw materials; intermediate products, dyes

and chemical reagents; lacquers and paints; machinery, apparatuses and automatic equipment; design and capital construction; engineering as well as a department of public relations.

As a result of management reorganization in industry and construction, the overall number of workers in the State and administrative structure economic managements have been reduced by 56 thousand persons. This yielded an annual saving in wages close to 600 million rubles (Note: I. Kuz'min, Reorganization of Industrial Management, "Pravda" 5 - 11 1958).

The sovmarkhoz'es were able to organize better utilization of material resources and equipment; to achieve significant results in the perfection of technical methods and organization of production; to increase the effectiveness of capital investments; to mobilize large additional reserves of increase in labor productivity and to increase production output.

The reorganization of management in industry and construction heightened the role of the republics of the Union, local Party, Council and trade-union agencies in the management of plants and building construction; drew additional millions of workers and employees into the production management, and created conditions for the still faster rise of socialist economics.

Technical and economic councils, operating as consultative organs, play an important role in the operation of the sovmarkhoz'es. Their staff includes important specialists, innovators and engineering organizations, Party leaders, and leaders of council, economic and trade-union organizations. The work of the technical and economic councils is one of the important forms of participation by the workers in the management of the national economy. Technical and economic councils study problems concerning the cooperation and specialization of enterprises on the basis of introducing advanced technology and new production methods, problems concerning further expansion of plants, shops and sections, and improvements in the work of inventors efficiency experts and others.

### 3. Administrative Structure of an Enterprise

Industrial enterprises are created by the Soviet State in an organized manner, their goals being the output of specified industrial products for the satisfaction of needs of the national economy and of the population.

All of the facilities of a State enterprise, as well as all the products it manufactures, belong to the people of the Union.

Types of products, quantities and output schedules are established for every enterprise, for a definite period (month, quarter, year) by higher agencies on the basis of the State national-economy plan.

The administrative structure of a large enterprise is shown in fig. 2.

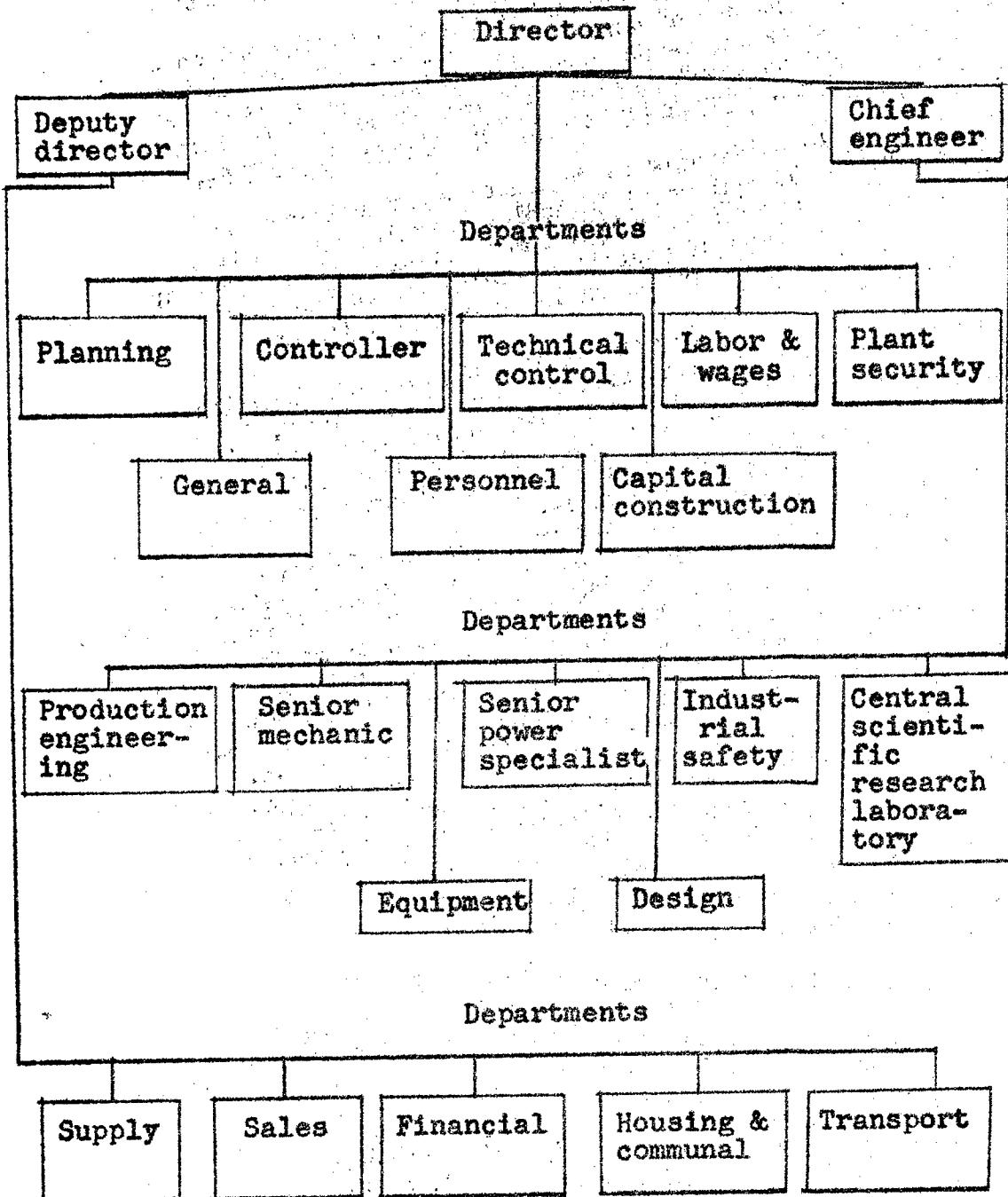


Fig. 2. Plant management structure in the chemical industry.

([Note:] The administrative structure adduced herein is applicable only to large enterprises with more than 5,000 workers having a large volume output of various products. The administrative structure in enterprises with a smaller volume is simplified. Instead of a separate department for industrial safety, the duties of the senior engineer of this activity are included in the production and engineering department; instead of a separate machinery department, the senior mechanic's department has an equipment engineer; the supply and sales departments are combined into one department; and the accounting and finance departments are also consolidated.)

The administrative structure in smaller plants is even more simplified. The planning and labor departments are consolidated; so are the departments of the senior power specialist, senior mechanic and designer; and the general and personnel departments also.)

The director is in charge of a plant. He bears the responsibility for the fulfillment of the program established for his plant in terms of quantity and quality of production; for the observance of financial order, for the safeguarding of socialist property and for the proper production management.

The director organizes the production process; he is responsible for the material and financial resources of the plant (within the scope of the program and in accordance with the law), supervises the selection and assignment of personnel, and carries out daily control over work performance.

In order to increase the responsibilities of directors of enterprises in the fulfillment of State plans, to introduce new production processes and technologies and to eliminate excessive centralization in solving economic problems, as well as to assure greater independence and efficiency of the plant management, the Soviet of Ministers of the USSR, in conjunction with the directives of the July (1955) Plenary Session of the CC CPSU, adopted, on 9 August 1955, the Statute "On the Broadening of Authority of Plant Directors." This statute gave plant directors authority to:

In the sphere of Planning: 1) to maintain a comprehensive tekhpromfinplan (Technical-industrial-financial plan) according to all the quantitative and qualitative indicators based on the yearly State Plan.

2) Change, within fiscal-quarter limits, the production schedule for the individual items (except those mass produced).

3) Accept orders from other agencies and organizations for the manufacture of products made from materials supplied by the customer, or from the plant's own materials and production waste, if it is not detrimental to the fulfillment of the program for production output in accordance with the nomenclatures set by the plant.

4) Change technological processes for improving the quantita-

tive and qualitative production indicators and so forth.

In the sphere of capital construction and reconstruction of the plants, to:

- 1) Approve monthly programs based on the yearly program for capital improvements established for the plant.
- 2) Introduce changes in the construction contracts with the appropriate redistribution of funds assigned for the individual construction units (by agreement with a contractor), but without altering the volume and operating schedules of additional plant capacities.
- 3) Approve minor capital improvement construction within the funds assigned to the plant for that purpose.
- 4) Acquire construction materials of local and cooperative manufacture.
- 5) Approve and alter proposed projects and estimated financial budgets for construction of objects not exceeding the estimated costs of five million rubles and not more than three million rubles for the construction of housing and communal, as well as cultural and welfare objects.
- 6) Approve yearly, quarterly and monthly programs for capital repairs and maintenance of buildings, structures and equipment within the limits of funds appropriated for capital repairs and maintenance.
- 7) When necessary to commit funds for the reconstruction of individual plants and modernization of plant equipment, such funds are set aside from the amortization surplus and are to be used for major capital improvements.
- 8) Establish budget accounts and measures for the introduction of new methods, mechanization and improvements in production technology, reationalization and intensification of production processes, and means for the amortization of these expenditures, up to one million rubles and two million rubles in large enterprises for one single measure.
- 9) Approve budget accounts for the execution of measures for organizing and expanding production of goods having widespread use and to improve their quality.

In the sphere of realization of material values to:

1) Transfer funds or issue materials and small auxiliary equipment from their own inventory to enterprises in the Union, republic or local industries and to industrial cooperatives, for the manufacture of products that are needed or that have been agreed upon by this particular enterprise.

2) Sell surplus materials, equipment, transportation facilities and other material values not usable by the plant, in cases when the appropriate department declines to undertake their redistribution and the respective marketing agencies do not accept them for sale.

3) Sell materials, instruments and other material values previously acquired by the plant through local procurement.

In the sphere of personnel, wages and financing, to:

1) Guided by the established organizational charts, maintain and change the structure of shop personnel, plant management forces, and within the limits established by its operational plans the number of office and engineering workers.

2) Establish and, in accordance with labor law, change rates of pay for individual supervisory personnel in plant management and in the shops within the limits established for this particular plant according to the official rates of pay and the established wage fund.

3) In agreement with the factory and plant trade-union committees, introduce for six-months periods, a sliding scale premium wage rate for work accomplished as a result of the acquisition of new equipment and new items of production, as well as a result of more important measures taken to master technological processes; these wage rates to be within the limits of the wgge fund established by the plant.

4) Utilize savings realized in the wage fund from preceding quarters in the payment of wages in subsequent quarters of the same year.

5) Issue emergency advances equivalent to not over ten-days' earnings to workers and employees in very exceptional cases.

6) Pay for travel expenses incurred with the study and introduction of new and advanced production methods, above those assigned and provided for in estimates of administrative and managerial expenses for such essential travels, but within the limits set in the production cost, etc.

In order to assure an efficient and businesslike leadership of the plant and continuous supervision over the production process, the director employs several deputies. The tasks of administration of the various departments at the plants is distributed among the director and his deputies.

The first deputy director is the chief engineer, whose responsibilities for the plant operation are equal to those of the director.

The chief engineer takes charge of the production functions of the plant. The chief engineer's responsibilities include: assuring the output of products in specified assortments and of appropriate quality; observing the established technological processes; organizing the repair and maintenance of equipment; controlling the work of the power plant facilities and maintaining an appropriate industrial safety standard.

The most important responsibility of the chief engineer is to administer the work in the development of equipment and production methods, and adaptation of new production forms, etc. In the achievement of the technical progress he relies on production experts and also takes steps for the introduction of useful and creative suggestions. The chief engineer is also in charge of training of personnel and the raising of their qualifications.

The other deputies of the director bear executive responsibilities for the separate activities of the plant.

Every enterprise has a general deputy director who supervises the departments of supply and sales, transportation, housing and communal services, and others. In plants that have commissary stores the activities of the plant's auxiliary economy, trading posts and in-plant feeding facilities are administered by the deputy director of workers' supplies.

In plants that have a large volume of major construction work, the director has a deputy in charge of construction.

The deputies exercise their responsibilities over their respective departments on the basis of one-man management. Administratively they are responsible to the director.

#### Office of the director

Directly under the director are a number of main departments which serve the following functions:

1) Planning department -- Formulates the "tekhpromfinplan" in the entire plant and for each shop on a yearly, quarterly and monthly basis; controls its operation; organizes the in-plant cost accounting and analyzes the economic activities of the shops and the plant.

2) Labor and wage department -- Formulates measures to increase labor productivity; organizes the work according to set output rates;

develops incentive wage systems; establishes manpower requirements for the shops and formulates work programs; analyzes indicators applicable to completion of work program; controls proper application of wage scale categories, wage scale rates and the wage payment system; enforces the observance of labor laws and is concerned with problems of industrial management and socialist competition.

3) Controller's department -- Maintains production records, records of finished products, expenditures of raw materials and intermediate supplies, determines the cost of finished product, maintains payrolls of workers and office employees, analyzes economic activities and controls the shops budgetary program.

4) Personnel department -- conducts the hiring and dismissal of workers at the plant; provides the plant with manpower; concerns itself with the interviewing and selection of personnel, maintains accounts and records related to the hiring and dismissal of workers (particularly of those who had been graduated from technical and trade schools and factory or plant training courses); completes, stores and issues pay-books to the plant workers.

5) Technical control department -- Controls the quality of finished products and incoming raw materials; determines the reasons for rejections and deviations from the technological rules, and works out measures for their prevention and elimination.

6) Capital construction department, or technical control department -- Carries on work connected with the plant construction program; instructs design agencies and receives design documents from them relative to construction; formulates construction plans and schedules; supervises the work of subcontractors; participates in the acceptance of the objects after completion of construction in those enterprises which have such position.

Besides all of the above enumerated departments, the general office is directly responsible to the director.

Plant security department and the Fire department are also responsible to the director.

#### Office of the Chief Engineer

Directly responsible to the chief engineer are the following departments, which perform their respective functions:

1) The production department -- Administers the organization of production and technological processes; sets up regulations for process performance, standards and technical conditions of production, controls the observance of technological regimes in the shops; compiles technical reports and analyzes plant production activities;

directs the introduction of improvements in the production methods and the technical training of the personnel; organizes schools for training workers in advanced work methods.

2) Senior mechanic's department -- Systematically supervises the condition of mechanical and technological equipment (except power facilities) and organizes all types of repairs; formulates and effects necessary measures for the economy of ferrous and non-ferrous metals, and also measures for the prevention of corrosion; issues general technical instructions to the personnel which instructions are related to repairs and maintenance of equipment.

The chief mechanic effects control over the work of the shops in the spheres of mechanical repairs, construction repairs and the prevention of corrosion.

3) Equipment department -- Provides the plant and new major construction units with new equipment; sets up installation plans and equipment specifications, and participates in the acceptance of new equipment.

4) Senior electrician's department -- Effects supervision over the condition of power equipment (boiler installations, motors, compressors, blowers, gas-generating and refrigerating equipment, sewage and filtering installations) and effects their repair. The senior electrician supervises the activities of the shops for the electrical repairs, communications as well as the functions of the steam power plant.

5) Construction department (bureau) -- Performs design work connected with the mechanization and automation of production; develops new installations and reconstructs existing ones, and designs individual pieces of equipment.

6) Central plant laboratory -- Controls the course of technological processes; participates in the activities for improving of production methods and intensification of processes; conducts work for the improvement of product quality, replacement of costly types of raw material and lowering of overhead expenses; develops new ways and technological means for new production forms; effects systematic supervision of shop laboratories.

7) Industrial safety department -- Works out measures for the safety of workers at the plant; determines the expenditures involved and controls the fulfillment of program and the expenditure of money allocated for this purpose; directly supervises the operation of ventilating equipment; checks the degree of air pollution in the shops; checks the correct installation of mechanical safeguards; participates in establishing the length of the working day and vacation periods

for workers in hazardous production areas, and controls the provision of workers with special diets and neutralizing substances.

This department controls the provision of workers with appropriate and special clothing and footwear, respirators and gas-masks; checks on their proper utilization and application; develops instructions for the workers in each occupation for the observance of rules in industrial safety; studies reasons for traumatism and occupational diseases and develops measures for their prevention; checks on the work of instructing and training workers in safe work habits.

The chief of the industrial safety department is responsible for the observance of established safety rules for various shops of the plant.

#### Office of the Deputy Director for General Matters

Directly responsible to the deputy director for general matters are a number of departments, performing the following functions:

- 1) Supply and sales department -- Supplies the plant with all kinds of raw materials, fuels, auxiliary supplies, packaging materials, lumber, etc.; maintains accounts relating to the realization of various funds; supervises the operations of the plant warehouses; sells and disposes of unusable materials.
- 2) Finance department -- Manages the financial operations of the plant; formulates and analyzes financial programs; manages operations with the banks; plans and conducts cashier operations.
- 3) Housing and communal services department -- Responsible for the condition and operation of the plant's housing fund; establishes cost estimates for the maintenance and repair of houses, provides rental service for the tenants.
- 4) Transportation department -- Directs plant outside and inter-shop transport system (rail and road). The department supervises operation of the rail depot, garage and transport equipment repair shops.

The Central committee of the CPSU and the Soviet government are conducting systematic work for the improvement, perfection and reduction in the cost of the industrial management organization.

Subsequent simplification of the structure and improvement in the functions of the organization and elimination of bureaucratic red tape should be the object of constant concern for all workers of the industry.

## Shopless System of Management

Particular attention in the matter of reducing the cost of the management organization is deserved by the experiences of several enterprises which have changed to shopless production management. The following enterprises in the chemical industry of the Council of the national economy of the Latvian SSR have changed over to the shopless management structure: "Ligo" phonograph record factory; "Varonis" rubber-goods factory; "Poligrafkraska (Polygraphpaints)" factory of the Moscow Municipal sovnarkhoz; "Krasitel" (Dye) factory of the Leningrad sovnarkhoz, and others. These enterprises have established sections of production instead of the shops, and are managed by senior mechanics directly responsible to the plant director. As a result of this form of management organization, the operational administration of production was improved and simplified. Simplification of the administrative structure enabled the collectives to attain steady outputs of products. A portion of the available technical personnel were channeled toward the strengthening of design and engineering departments.

A Moscow plant manufacturing lighting equipment and fixtures had the following management organization: 12 plant-management departments and seven production shops which included 15 sections. Eighteen persons in technical and seven persons in office capacities were occupied in the production control for every 100 workers. After the change-over to the shopless structure of organization, the 12 departments were reduced to seven. A special design bureau was merged with the engineering department; the personnel department with the labor department; the financial department -- with the accounting department; and the department of material and technical supply -- with the sales department. Instead of the independent shops, production sectors were formed under supervision by senior mechanic.

The consolidated plant-management departments took upon themselves the duties of the shops with respect to planning, rate setting, equipment repairs, etc., and as a result their roles grew in the maintenance of steady production function of the plant.

The reorganization was particularly beneficial for the technical administration of production. With an overall 25% decrease in the size of the management organization, technical services were increased two-and-a-half times. Under these circumstances, the consolidation of the design and engineering departments very quickly led to technical progress in the production.

If prior to its reorganization 66 rubles were spent in the support of the management structure for every 1,000 rubles-worth of gross output, then in 1956 this expenditure was reduced to 44 rubles, and in 1957 -- to 28 rubles. As a result of the change-over to the new system of production managements, the annual savings in labor costs amounted to 500 thousand rubles in 1957.

Under shopless management structure the administration of the plant is brought closer to the production sections; the role of the production supervisor is enlarged as are his responsibilities for the work of his section; duplication is eliminated in the operation of management and of the shops; planning quality is improved, as are the preparations for production and the supply of materials and technical equipment; the number of production, material and equipment records is reduced; more proper placement and efficient utilization of qualified technical personnel is assured; the number of administrative personnel is reduced and superfluous administrative functions are eliminated. The number of technical and office workers decreased as a rule for every 100 production workers at all plants which had changed over to the shopless management structure, and the technical-economic indicators were higher than the average indicators in corresponding plants which had retained the old management structure.

Local leading economic and various soviet agencies should study thoroughly the experience of the shopless management structure and recommend its application at all enterprises.

Significant economies are realized as a result of the introduction of the shopless structure, which contributes to the strengthening of the engineering design and scientific research organizations concerned with the development and introduction of new items of production and the perfection of technological processes, and also with the improvement of technical services provided by various enterprises.

Broad application of the shopless management structure in production at small and medium-sized plants is a realistic and essential step toward the realization of the common goal for the perfection of industrial management.

#### 4. Shop Management Structure

The plant has main and auxiliary shops.

The main shops perform the technological process in the manufacture of products. Thus, for example, the plants that produce synthetic rubber from alcohol have main shops for catalytic cracking, condensation, gas absorption, polymerization and processing. Plants engaged in the production of rubber footwear have the following main shops: preparatory, calendering, cutting and storing, assembly and vulcanizing.

The continuous operation of the main shops is assured by auxiliary shops. These include mechanical, electrical, building repair and maintenance shops, and also the plumbing, compressor and boiler shops and the electric power substation.

The shop superintendent is directly responsible to the plant director (through the chief engineer); the various administrative departments of the plant are not allowed to direct orders to the shop superintendent. The shop superintendent is the technical and executive head and bears the responsibility for the completion of programmed goals established for the shop. The shop superintendent answers for the compliance with the current industrial safety rules, for sanitary conditions in the premises and cleanliness in work areas.

The shop superintendent has a deputy who is the technical head of the shop (fig 3).

The care and routine maintenance of shop equipment is handled by the shop mechanic, who has a maintenance crew at his disposal.

In order to realize measures for work scheduling and wage scale, each shop has its own rate-setter. The rate-setter establishes output rates and maintains records of their fulfillment. He discovers reasons why individual workers do not fulfill their output rates and suggests measures for the elimination of these reasons. He works out a system of incentive pay for reduction in rejects, for economy of raw materials and supplies, etc.; watches for the proper application of the wage rate for workers and technical personnel; controls the payment of bonuses, deductions for spoilage; checks the correct application of wage-scale categories and rates.

The rate-setter, together with the technical personnel of the shop, studies the work of the production experts and promotes the application of better time and motion methods.

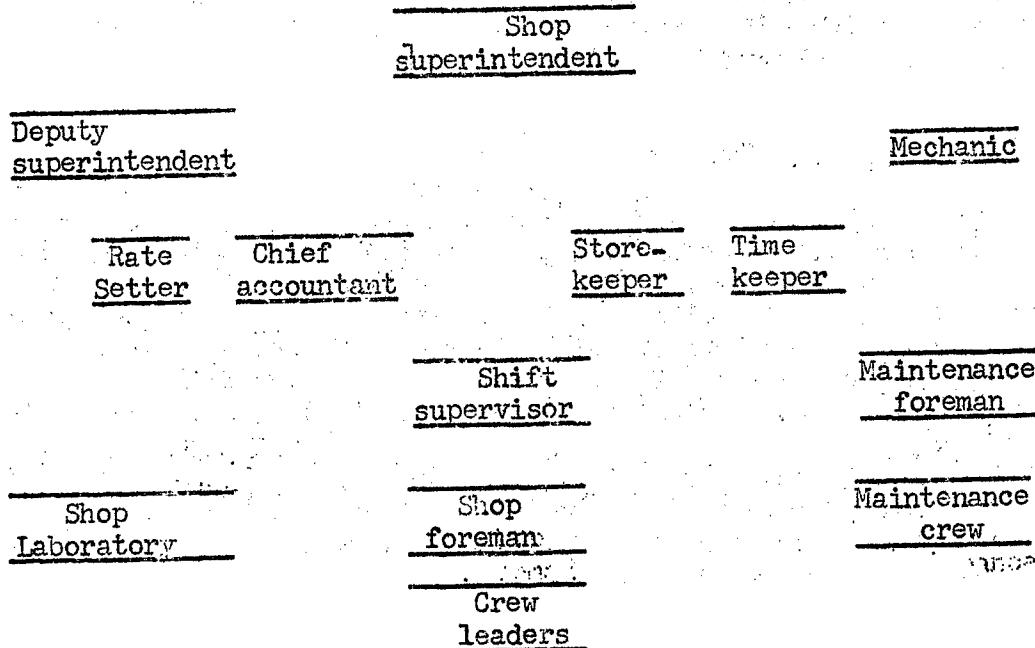


Fig 3. Shop management structure

The shop's timekeeping records are handled by the timekeeper who checks accurate attendance at work. Thirty minutes before commencement of the work, the timekeeper opens the time-card board and as the workers arrive they remove their time-cards from the board. All cases of tardiness together with the number of late minutes are entered by the timekeeper in the record book, in which the violations of work discipline are recorded. This record book, accompanied by documents and references supplied by the workers as excuses for absence or tardiness, are submitted daily to the shop superintendent for his review.

The timekeeper makes daily reports to the plant director, through the shop superintendent, concerning cases of absences from work stations and other violations of work discipline.

The data from timekeeping records form the basis for computing the wage earnings.

The shop accountant pays the workers and the shop-office personnel; calculates shop's production costs; calculates the unfinished portion of output of the shop production as well as the tekhpromfinplan completion results.

Shop laboratory maintains routine technical control over production, and studies possibilities for technological improvements in production.

The various shifts have their own shift supervisors.

#### Shift Supervisor

The shift supervisor is the responsible administrative and technical leader of the shop during his shift (from the start of the shift to its end); he supervises the proper observance of established technological order (regimes) and takes measures for the elimination of interruptions and troubles. In the event that the shift supervisor cannot maintain normal conditions during his shift with the available personnel, he should inform his shop superintendent accordingly, and, if necessary, the plant administration.

The shift supervisor is responsible for the maintenance of work discipline during his shift; for the observance of technological regimes; for the fulfillment of shift assignments according to all production indicators; for the observance of the industrial safety rules and fire-prevention measures.

The shift supervisor organizes socialist competition among the workers of his shift.

#### Foreman

Foreman is a competent leader of the section delegated to him and has the responsibility for completion of production assignments. The foreman organizes directly the production process in his section. Instructions from shop management to the workers are always

routed through the foreman who is responsible for compliance with such instructions.

The foreman must: supervise timely supply of workers with raw materials and supplies; instruct and assist workers in the accomplishment of their respective tasks; watch for observance by the workers of established technological regimes and industrial safety rules; assure high production quality and prevent rejects; supervise proper use of equipment.

The foreman answers for the maintenance of work discipline in his section and for the fully productive utilization of the working day; he organizes socialist competition among the workers in his section.

The Soviet of Ministers of the USSR, in its decree of 20 September 1955, noted that many directors underrate the role of the foreman in the production; do not consult him for the solution of production problems, effect changes in production goals and work scheduling without the foremen's participation, interfere with their functions and even transfer workers to other jobs without the knowledge of the shop foreman. In most cases the foreman does not have adequate influence on the assignment of workers in his section and in the establishment of output rates and prices, and is deprived of the right to establish and change workers' wage-scale categories.

The Soviet of Ministers indicated that it was quite abnormal for the foreman to spend much of his time unproductively -- in the performance of various kinds of electrical, intermediate and house-keeping functions, unrelated directly to the supervision of production and of subordinate workers.

In order to eliminate the serious deficiencies in the direct supervision of production, the Soviet of Ministers of the USSR decreed the following rights for the foreman: to recruit workers and assign them at his discretion, within the limits set for the number of workers in his section; to transfer workers to other work within the section in the event it is warranted by production requirements; to release surplus workers with the approval of the shop superintendent and also to dismiss workers from the plant who systematically violate production of work discipline; to apply wage scale rates to workers, with the approval of the shop superintendent, corresponding to the wage scale evaluation guide-book, awarded bonuses to workers with higher production accomplishments, exemplary work and successful fulfillment of tasks, from the sums of the bonus fund which is allotted monthly by the plant director to the foreman amounting to 3% of the wage fund for the section; impose disciplinary action, in accordance with the regulations governing internal work routines, on workers who produce inferior work or violate production or work disciplines and to transfer workers to lower-paid jobs when they systematically, and due to their own negligence, fail to fulfill established production norms and are indifferent to the poor quality of their work.

In order to strengthen the role of the foreman, the Soviet of Ministers of the USSR established that the positions of foremen should, as a rule, be filled from the ranks of engineers and technicians. Highly qualified workers may assume the duties of foremen if they have been graduated from technical schools and are in possession of a certificate attesting to their right to assume the duties of a foreman.

To prepare qualified foremen personnel from the ranks of young specialists -- engineers and mechanics -- it is permissible to establish a position of an assistant foreman at the plant.

Realizing that production leadership in the shops of plants in the chemical industry is basically effected by the shift supervisor, the Soviet of Ministers of the USSR, in its directive of 9 July 1956, extended foremen's rights on the shift supervisors.

#### Brigade (Crew) Leader

The brigade leader is not, ordinarily, released from production duties, and works alongside the other members of the brigade. The basic duties of the brigade leader are to instruct the workers of his brigade and render technical assistance in the performance of their work. At the same time, the brigade leader is responsible for the maintenance of equipment and its proper use. In the event of damage or breakdown of equipment he is obliged to report these immediately to the shift superintendent, to whom he is directly responsible. The brigade leader should strive for economical expenditure of his brigade's production resources and should maintain the quality of work and take measures to prevent spoilage. The brigade leader heads socialist competition in exceeding output norms, in the economy of raw materials and output of high-quality products. For leading the brigade, he is chosen from the ranks of piece-workers, and not released from his prime duties, and is paid as follows: in a brigade of five to ten persons -- 10%, and in a group with more than ten persons -- 15% above the wage scale rate.

#### 5. Party and Trade-Union Organizations Within the Plants

Public activities of the collective body of workers at the plant and also the work of trade-union and Komsomol organizations, are led by the Party organization of the plant, headed by the Party committee.

The management of a socialist enterprise assumes close relations between the administrative, Party and trade-union organizations. This provides for the active participation of the entire collective body of workers, technical personnel, and office workers, in the fulfillment of production programs of the plant and promotes the development of their creative initiative, directed toward increasing labor productivity, improving the quality of products and lowering their cost.

The Party organization at the plants unites the collective body, heads the general political measures taken at the plants, and mobilizes the workers for the fulfillment of goals set by the Party and the government. With the initiative of the Party organizations, enterprises conduct production and technical conferences and other functions promoting the productive and political activities of the workers. The Party organizations concerned with production have the right to control the activities of the administration.

The June (1959) Plenary Session of the CC CPSU indicated that, at the present time, the main link in the activities of Party organizations is organizational work for the implementation of programs projected by the XXI Congress of the Party in the field of technical progress, which is the decisive condition for the successful fulfillment of the Seven-Year Plan.

Considering the present forms of organizational control as inadequate and not responsive to new requirements and goals, the CC CPSU made it obligatory for the main local party organizations in manufacturing enterprises to form commissions to effect control over the administration activities.

The main task of the commission would be to effect systematic control over the timely completion of the enterprise's production assignments, state orders and deliveries of all products of high quality, and to fight for technical progress.

As a rule, three commissions are formed at the enterprise. One -- for controlling the completion of the State plan and of co-operative deliveries; the second -- for introducing new equipment, automation and mechanization of production; the third -- for maintaining quality of production. The commissions are not controlling agencies existing concurrently with the Party organization but are one of the organizational forms through which the primary Party organizations implement assignments set them by the CPSU's Decree giving them the right to control administrative activities.

The Lenin Komsomol is the active assistant to the Party organization at the Plant. At many plants youth comprises nearly half of the collective body of workers and therefore the work among them, developing highly qualified foremen from their ranks who will actively participate in the social and productive life of their plant, is the most important assignment for the Party organizations.

The trade unions play an important role in the life of the plant. Soviet trade unions are schools for communism, schools for the education of the workers. They contribute to the workers' active participation in the development of the national economy; they concern themselves with further improvement in the material well-being and cultural level of workers; they control labor production laws and industrial safety measures and participate in establishing of output rates and wage payment systems.

The trade-union organizations achieve improvements in medical care provide the workers with passes to sanatoriums and rest houses; participate in the assignment of living quarters in the enterprises' housings; organize the working control of dining rooms, stores and other auxiliary services.

The plant committee of a trade union, in accordance with regulations "Concerning the rights of the factory, plant, local committee, of the trade union," ratified on 15 July 1958 by Decree of the Presidium of the Supreme Soviet of the USSR, represents the workers of a specific plant in all matters concerning labor, mode of life and culture.

The committee has the right to participate in the development of production plans for capital construction; the right to hear reports of plant or institutional managers concerning the completion of production programs and obligations arising out of collective agreements; to demand of the administration the elimination of known deficiencies; and to make proposals to the above-mentioned executive and council organs for the improvement of operations at the plants or institutions.

The trade-union committee leads the following activities at the plant: the formation of production meetings, organized at the present time by permanently functioning agencies; conducts workers' assemblies and production and technical conferences, systematically controls the execution of their rulings and suggestions by the workers and the other personnel. Together with the administration, the trade-union committee organizes socialist competition and sums up the results, determines the winners in the competition, and decides questions concerning the encouragement of the leaders in the competition. The trade-union committee has control over the timely introduction of accepted inventions and efficiency experts proposals.

In accordance with the decree of the December (1957) Plenary Session of the CC CPSU, permanent functioning factory-plant production meetings have been created at the enterprises, and also production meetings in large shops. Workers, technical and office personnel, as well as the representatives of the administration, Party and Komsomol organizations, and scientific-technical societies participate at these meetings. The participation of the plant managers in the functions of these meetings is compulsory.

The staff of the committee of the general plant permanently-functioning production meeting at the "Kauchuk (Rubber)" plant numbers 131 persons. The number of persons in the shop permanently-functioning production meetings fluctuates between 21 and 23. These meetings examine production plan projects; problems concerning the organization of production and labor; technical standards; capital construction; perfection of internal plant management and other matters concerning the productive activities of the plant.

The production meetings have the right to hear reports from the administration, conduct inspections of plant operations, and inform the sovmarkhoz of their conclusions concerning planned projects. In order to provide continuity to the production meetings, a small, permanent executive organ is created -- the presidium of the meeting. In order to attract the broad masses to their work, it is necessary to prepare questions worthy of consideration in advance, with the participation of various temporary commissions and teams.

The trade-union organizations and the administration of the plant conclude yearly collective agreements.

A collective agreement represents a two-sided obligation on the part of the collective body of workers and the administration, directed toward the completion and overfulfillment of the production program, and improvement in the material and cultural conditions for the workers.

At the negotiations for the collective agreement, the administration appears as the representative of the plant, and the plant committee as representatives of the workers and other personnel in this particular plant.

The director of the plant, and the plant committee, draw up a draft of the collective agreement, which is discussed at shop and various shift meetings of workers and other personnel.

After such discussions, accepted corrections and additions are included in the draft of the collective agreement and it is then submitted to the general assembly of workers and other personnel, and at large plants - for discussion at plant conferences.

The conclusions of new collective agreements are preceded by mass verifications of the fulfillment of collective agreements for the past year. The summing-up of the results of such verifications and discussions of the draft of new agreements are conducted at general assemblies (conferences) held for both workers and clerks of the plants simultaneously.

In those cases where disagreements arise between the plant director and the plant committee after the conclusion of an agreement these disagreements are transmitted for resolution to the sovmarkhoz and the regional council of the trade union.

After the plant director and chairman of the plant committee sign the collective agreement it is registered at the sovmarkhoz and the regional council of the trade union. The registered collective agreement must be published in the required number of copies and delivered to every worker and other employee. Daily control over the observance of the collective agreement is conducted by permanent commissions of the factory-plant committee together with representatives of the administration. They not only maintain records of the fulfillment of obligations in accordance with applicable sections of the collective agreement, but actually assist in converting these obligations into practice.

The trade-union organizations must assure the unconditional observance of collective agreements. The December (1957) Plenary Session of the CC CPSU indicated the necessity "to increase the role of the trade unions in the development and completion of the promfinplan of the enterprise, in the resolution of questions concerning the establishment of rates and the organization of labor and wages, improvements in industrial safety techniques at enterprises, and, particularly, in the resolution of problems connected with housing construction and improvements in the material and general conditions of workers and other personnel." Practice has shown that when trade union organizations show initiative and persistence and really exercise their rights they always achieve successes in increasing labor productivity and improving working conditions in production.

The fulfillment of obligations adopted by the collective agreements contributes to the successful completion of the national economic plan and to further increases in the material prosperity and cultural level of workers and other personnel.

The proper coordination of work between the administrative, Party, Komsomol and trade union organizations has great significance for the successful completion of production plans and goals by the enterprises.

### Chapter Three

#### LABOR MANAGEMENT

##### 1. Significance of the Systematic Growth of Labor Productivity

The main and decisive condition for successful realization of the plans for communist building in our country is the steady rise of labor productivity.

Labor productivity in industry is measured by the output of a single worker or a single worker performing in a given time unit, or the work time involved in the manufacture of one unit of production ([Note] Up to 1959 accounts of labor productivity were rendered in terms of one worker, and since 1959 -- one worker and a single worker performing in a given time unit). Growth in labor productivity means an increase in production output in a time unit (man-hour, man-day, man-month, man-year).

Output is determined by dividing production volume by work time:

$$V = \frac{M}{T}$$

where  $V$  - output;  $M$  = production volume;  $T$  - work time.

Production output is determined in terms of quantity or in terms of cost (value).

The quantity of production output in a time unit or for one average worker in a year (month, day, hour) is expressed in tons (soda, sulfuric acid, synthetic rubber, etc.). However, this method of computing labor productivity can be successfully applied only at enterprises manufacturing one kind of product. Chemical enterprises, as a rule, produce a variety of products and the computations of labor productivity are usually expressed in terms of cost; in this case production output is determined according to wholesale prices. Hence this index may be compared to the level and dynamics of labor productivity not only in various branches of the chemical industry, but to the country's industry as a whole.

The systematic rise in labor productivity has paramount significance for further development of industry and of the entire national economy, for improvement in the material prosperity and in the raising of the cultural level of the workers, as well as for the building of a communist society. Lenin wrote: "In the final analysis, labor productivity is most important, most essential for the victory of the new social order. Capitalism created labor productivity, which had been unheard of during serfdom. Capitalism may in the end be beaten, and will in the end be beaten because socialism is creating a new and much higher level of labor productivity" (Note: V. I. Lenin, works / in bibliography /, Volume 29, page 394).

The Communist Party has led, and is leading, the daily and persistent struggle for a steady rise in labor productivity at all stages of socialist construction.

The rise in labor productivity in industry during the years of socialist building in our country is characterized by the following data: (in %):

|  |           |
|--|-----------|
| First Five-Year Plan<br>(1932 to 1928)                 | 141       |
| Second Five-Year Plan<br>(1937 to 1932)                | 182       |
| Three years of Third Five-Year Plan<br>(1940 to 1937)  | 133       |
| War years and Fourth Five-Year Plan<br>(1950 to 1940)  | 137       |
| Fifth Five-Year Plan<br>(1955 to 1950)                 | 144       |
| Seven-Year Plan for USSR development<br>(1965 to 1958) | 145 - 150 |

Soviet industry has achieved much higher rates of growth in labor productivity than have the industries of the more developed capitalist countries. Thus, in 1957, labor productivity in USSR industry increased by approximately 9.5 times in comparison with the productivity of labor in pre-revolutionary Russia (1913). During the same period in England's industry it rose 1.4 times, and in that of France -- 2.1 times. (USSR in Figures, a Statistical Collection, Gosstatizdat, 1958, page 32).

To realize the basic economic goals of the USSR -- to catch up with and surpass the more developed capitalist countries with respect to consumer goods -- it is necessary to provide for a new and much faster increase in labor productivity at all socialist enterprises.

Significant successes in the systematic increase of labor productivity have been achieved by the chemical and rubber and asbestos industries; the data is adduced below:

|                                     | 1940 | 1950 | 1951 | 1952 | 1953 | 1954 | 1955 |     |     |
|-------------------------------------|------|------|------|------|------|------|------|-----|-----|
| <b>Chemical industry</b>            |      |      |      |      |      |      |      |     |     |
| (including chemical mining)         |      |      |      |      |      |      |      |     |     |
| in % compared to 1940               | 100  | 171  | 176  | 202  | 200  | 219  | 239  | 260 | 293 |
| in % compared to 1950               | 100  | 113  | 125  | 136  | 148  | 166  |      |     |     |
| <b>Rubber and asbestos industry</b> |      |      |      |      |      |      |      |     |     |
| in % compared to 1940               | 100  | 188  | 197  | 209  | 227  | 245  | 268  |     |     |
| in % compared to 1950               | 100  | 105  | 111  | 121  | 131  | 143  |      |     |     |

(USSR Industry, A Statistical Collection, Gosstatizdat, 1957, page 191.)

Systematic growth in labor productivity is the basic means for production development and lowering of production costs, and, consequently, further improvement in the prosperity of the people.

Owing to the growth of labor productivity during the first Five-Year Plan there was an increase of 51% in aggregate industrial production, during the second Five-Year Plan -- 79%; during the war years and the years of the fourth Five-Year Plan -- 69% and during the fifth Five Year Plan -- 68%.

The XXI Congress of the CPSU, in its budget-control figures for the development of the national economy for 1959-1965, forecasts a new mighty upsurge in labor productivity which is the decisive condition for the fulfillment of goals relating to production growth. Labor productivity in industry should increase by 45-50% for each

each worker during the Seven-Year Plan. As a result of the rise in labor productivity, there will be an increase close to 2/3 in industrial output. Since the volume of industrial production in our country is huge, every percent of growth in labor productivity represents an increase of one billion rubles in production output.

The entire nation is interested in the continued growth of labor productivity, and plant administrations are forced to create suitable conditions for each worker so that he can work more efficiently.

Workers in a capitalist society are subjected to severe exploitation. Because of that they are not interested in increasing labor productivity since it is inevitably accompanied by a reduction of wages and a rise in unemployment, and causes further hardship on the workers.

An entirely different situation exists in the USSR -- a socialist country, where private possession of implements and means of production have been eliminated and the exploitation of man by man has been abolished; where the goal of production is not profit but the satisfaction of the material and cultural requirements of the people. In view of the general rise in production and increase in labor productivity, the Communist Party is setting its goal toward gradually going over to a shorter work day, and toward creating better conditions for the increase in the cultural and technical standards, as well as in free time for workers and other employees.

The duration of the work week for workers and office personnel in the chemical industry has been reduced to 41 hours, and for individual groups of workers to 36 hours; and, furthermore, the change-over to the shorter work day was effected without reducing wages.

Thus the goals of the Seven-Year Plan, in terms of production growth and increase in labor productivity as well as of other indicators, should be accomplished while significantly decreasing the overall expenditure of work time. Under such conditions the significance of the full and productive utilization of every minute of work time by all workers grows immeasurably.

The aim is to have every worker contribute actively to the elimination of deficiencies in the organization of the production process and to strive for increased labor productivity.

The intensification of technical progress in our industry, mechanization and automation of industrial processes, improvements in labor and wage management, further development of mass socialist competition, are all powerful factors in the growth of labor productivity.

## 2. Basic Principles for the Increase in Labor Productivity.

### Mechanization and Automation of Production Processes.

The rapid growth of labor productivity in the USSR is, first of all, the result of widespread introduction of new industrial

methods and the improvement in production technology; it is also the result of mechanization and automation of production processes. The socialist system, by putting into practice Lenin's party line indicating the primary importance of the development of production facilities in industry, opens unlimited possibilities for the application of the newest technical methods and scientific achievements.

In the development of technical knowledge and in the development and improvement of production tools, chemistry plays an exceptionally significant role. Chemical processes, penetrating into every branch of the national economy, promote the intensification and growth of material production, improve the production quality, and the economy of social labor. As a result of the chemicalization of production processes, production output in units of time has increased considerably in comparison to the traditional production methods. The chemicalization of production processes provides for the improvement of technology, that is, gradual replacement of less productive and labor-consuming methods with more effective and less labor-consuming means for product manufacture. Owing to the development of chemical science and methods, machine technology is giving way increasingly to chemical technology. At the present time there is not a single branch of industry which is not, in one way or another, related to the application of chemical processes. The chemicalization of production lightens labor and increases its productivity.

Of special significance for the growth in labor productivity is the automation of production, which results in radical changes in working conditions and raises industry to higher technical levels. The realization of automatic production processes, without any direct intervention of human hands, is an important factor in the elimination of present differences between mental and physical labor.

That is why problems concerning the automation of production at the present time are receiving a great deal of attention, and its highest possible introduction into all branches of the national economy is becoming a function of prime significance.

The June (1959) Plenary Session of the CC CPSU worked out a definite program for the further development of the complex mechanization and automation of production. At the same time, the Plenary Session stressed the fact that the realization of measures for the mechanization and automation of production has important social and economic significance.

Most of the processes in the chemical industry are continuous, and this creates more favorable conditions for their automation.

Automation in the chemical industry not only contributes to the production and growth of labor productivity, but also provides for stability of technological processes, perfection in controlling and regulation of production processes, and improvement in production quality and industrial safety.

During the post-war years, considerable work in automation of technological processes has been effected in the enterprises of

the chemical industry. In the production of synthetic rubber and synthetic alcohol processes have been automated for catalytic cracking, condensation and rectification of alcohol, absorption and isolation of divinyl and a number of other processes.

As a result of the automation of the production of synthetic rubber, the daily output of alcohol at the Sungaitskiy plant has been increased by more than 70% and the number of attending personnel has been reduced to one half.

At the Efremovskiy SK (synthetic-rubber) plant, the automation of temperature conditions in the catalytic cracking process resulted in savings of alcohol amounting to more than one million rubles a year; the cost of installing automatic equipment amounted to approximately 500 thousand rubles ([Note] N. N. Elshin, N. Y. Festa, Automation of Chemical Production, "The Chemical Industry," No 7, 1957, page 49).

A three-year operation of an automatically controlled shop for the regeneration of acetic acids at the Vladimirskiy chemical plant resulted in considerable decreases in the operating ratio in the use of raw materials and power, and in the decrease in the number of attending personnel and the lowering of production costs.

Expenses for the production of acetic acids decreased as follows: (in %):

|                |      |
|----------------|------|
| Ethyl acetate  | 17.2 |
| Steam          | 13.6 |
| Electric power | 15.5 |
| Water          | 18.6 |

At the same time, shop personnel decreased by 30% and labor productivity increased by 46%.

As a result, the cost of refrigerated acetic acids decreased by 17.5% and automation expenses were paid for in 2.5 months. The annual savings amounted to 2.6 million rubles ([Note] V. E. Miroshkin, V. P. Valovik, Experiments in the Complex Automation of A Shop Engaged in the Regeneration of Acetic Acid, "The Chemical Industry," No 8 1958).

In the production of caustic soda and chlorine the basic functions of electrolysis and the production of synthetic hydrochloric acid have been automated. Automation is being introduced in shops for the evaporation of electrolytic alkali.

In the production of soda ash, the carbonizing and distilling units have been eliminated. Production of the distilling element increased by 12% as a result of automation and steam consumption decreased by 8%. Owing to automation, the Slavyanskiy soda plant achieved economies in steam consumption amounting to 775 thousand rubles per year.

Successful work is being carried on at sulfuric acid plants in the automation of the air drying-absorption unit of contact process acid. The results of these operations at the Shchelkovskiy chemical plant permitted an increase of 2% in the output of sulfuric acid.

A system has been developed for automation of the production of sulfuric acid from concentrated sulfuric anhydride, which is extracted during scrubbing of exhaust gases from the heat and power plants.

Designs have been developed for an experimental automatically controlled shop at the Dorogomilovskiy chemical plant with an output of ten tons per day.

The automation of operating units at a number of superphosphate plants assured the observance of established rates, concentration and temperature of diluted sulfuric acid, and also the expenditure of phosphate raw materials.

As a result of this, for instance, the input of phosphate raw materials at the Vinitskiy superphosphate plant was decreased by 0.5%, and sulfuric acid by 0.9%; at the same time the number of attending personnel decreased and labor productivity was increased.

The annual savings at the plant amounted to 750 thousand rubles and the cost of automation amounted to only 350 thousand rubles.

Complete automation is being effected at the Lisichanskiy chemical kombinat in the production of ammonium nitrate.

Production of synthetic acetic acid and caprolyoctane has been automated at organic-synthesis plants.

Individual thermoplastic plants have automatic processes for operation of hydraulic presses and for temperature control.

As a result of automation, basic plants at the Okhtenskiy chemical kombinat, labor productivity increased by 25%, cost factor for raw materials and power decreased by 15%, and the number of personnel decreased by three quarters.

At plants producing rubber articles and tires the unloading and selection of rubber from mixing mills has been automated, as have the selection of rubber cuttings and vulcanization in calenders and in individual vulcanizing machines. As a result of automation the vulcanizing processes at the Moscow plant "Kauchuk (Rubber)," production output increased by 9%.

Production of aniline, phthalic anhydride and benzidine has been automated in the aniline-dye industry.

Despite the known successes, the level of automation of production processes in the chemical industry remains low. Complex automation has been introduced very inadequately; basically, only individual technological processes and equipment have been automated. Consequently, automatic measuring and regulation devices are not connected with each other in a unified system for the organization and administration of the production process.

The All-Union Conference on automation in the chemical industry, held in Moscow in August 1956, indicated that complex automation of chemical processes is being retarded because of lack of automatic equipment in terms of quantity as well as variety.

The rate of automation is being adversely influenced also by the absence of required attention to the automatic controls in the shops on the part of individual plant managers.

The Seven-Year Plan for the development of the national economy programs, the intensification of work in automation in chemical industry, and for complex automation of all basic chemical processes. The transition from individual automated units to the automation of shops and technological processes is being contemplated, as is the creation of fully automatic plants. Complex automation of plants must be effected in the production of nitric acid and soda ash, double superphosphate and ammonium phosphate; and there are also plans to build and put into operation an automatically controlled shop for the production of sulfuric acid.

The design of the Nevinomyskiy nitrogen-fertilizer plant provides for automatic production of ammonia, weak and concentrated nitric acid and ammonium nitrate. As a result of automation, the number of attending personnel at the plant decreased by about 35-40% in comparison with the staff contemplated by the designs prior to automation. The cost of automation will be repaid in two to three years.

The manufacture of conveyor belting, driving belts, pressure and suction hose is being readied for line production. The line production of large numbers of automobile tires will be automated through the whole technological process; the output of galoshes will double with the use of the die-stamping method.

The Seven-Year Plan forecasts the complete mechanization of heavy and labor consuming work. This has particularly practical significance for the chemical industry, because in sulfuric acid, phosphate, nitrate, soda, carbide and potassium plants it is necessary to process hundreds of thousands of tons of pyrite, phosphorite, apatite, potassium chloride, coal, coke, limestone, chalk and other raw materials. The mechanization of transport in these branches of industry also contributes considerably to growth in labor productivity and easing of working conditions.

#### Raising the Cultural and Technical Level of Workers.

In conjunction with equipping of plants with new machinery, the systematic raising of the cultural and technical level of workers has acquired great significance.

The Soviet government expends huge sums of money on the training of personnel capable of fully mastering new technical knowledge.

Technical schools have been created for the training of highly qualified working personnel from the ranks of young people who have had secondary education.

During the fifth Five-Year Plan the academies and schools of the Main Department of Manpower Reserves, of the Soviet of Ministers of the USSR, trained 1,736,000 persons, including 27,000 at technical academies, 719,000 at trade schools, and 990,000 at the plant training schools.

In 1957 alone, the qualifications of 4,074,000 workers were increased in USSR industrial enterprises. The scheduled figures of development of the national economy of the USSR for 1959-1965 provide for an increase in the total output of specialists with higher and secondary educations by about one and a half times. Moreover, plans are being made for a considerable expansion of evening and correspondence schools for secondary and advanced specialized training, in order to provide broader possibilities for practical engineering and technical personnel as well as to allow workers to acquire secondary and advanced specialized training without discontinuing production work.

All these measures will promote the further increase in the cultural and technical level of the workers, which fact will assure further growth in labor productivity.

#### Improving the Management of Labor

Growth in productivity is promoted by the proper work scheduling, tied in with, first of all, the proper organization of the work area; equipping it with all the necessary machinery and devices; observing order and cleanliness in the work area and creating normal sanitary and hygienic conditions.

Improvements in work scheduling and increases in productivity are promoted by the proper organization of technical standards and wages, full utilization of the work day and observance of working disciplines and rules governing internal order, and also observance of industrial safety and labor protection at the enterprise.

#### 3. Basic Principles of Socialist Management of Labor

##### Recruiting, Training and Improving the Qualifications of Production Personnel

Production personnel must be provided for the enterprise in a systematic and organized manner. The principal sources for the recruitment of qualified personnel are the trade and technical academies and schools for plant training, and also the individual-team training of new production personnel.

Trade academies prepare the following personnel for enterprises in the chemical industry: equipment operators, laboratory assistants operators of compressor installations, equipment-maintenance men, electricians, electric-motor winders, gas and electric welders

and workers in a number of other trades.

Young people graduated from secondary schools are trained by technical academies to become qualified workers in professions requiring a higher general educational level (such as equipment operators and laboratory assistants).

Factory-plant training schools prepare workers predominantly in the auxiliary trades, carpenters, plasterers, bricklayers, joiners, painters.

Side by side with the recruitment of personnel trained within the manpower reserve system, plants systematically attract and prepare new workers by individual and team training and also conduct work for raising the qualifications of veteran workers.

Workers with chemical specializations are assigned to instructors under whose leadership they learn practical skills for other work fields. While training to become qualified craftsmen, electricians, and operators of compressors and pumps, new workers are assigned as assistants to qualified workers in these occupations.

Instructors for production training are selected from among the best brigade leaders and qualified workers, who have produced articles of exceptional quality. Every new worker is trained in the most modern work methods so that he can achieve the existing standards of high-quality production output in the shortest possible time.

During the individual-brigade preparation of new workers, concurrent with production training at the work area, these workers receive theoretical training under the leadership of experienced engineering personnel.

Training programs include the study of physico-chemical properties of raw materials and intermediate products, equipment layout and technological process schemes, production control methods, basic principles of work scheduling, production economics, and industrial-safety rules.

Training of new workers is considered to be successfully completed when they pass a qualifying test, within the scope of the production and theoretical training program, under conditions where they independently perform the technological process and fulfill the output norms.

Production technical and special-purpose courses are organized to raise worker qualifications.

The systematic raising of production qualifications and cultural and technical levels of workers takes the form of production and technical courses of three to eight months.

Special-purpose courses, of two to six months, are organized for the study of newest advances in equipment, technology and economics in production, and also to increase the knowledge of workers in the various branches of production (blueprint reading, study of measures for the prevention of waste, etc.)

Workers are taught second vocations (specializations); for instance, equipment operators learn to be shop laboratory assistants or craftsmen.

Workers train in the more perfected work methods in special schools for advanced training; courses last from one to one and a half months.

### Socialist Labor Discipline

The proper work scheduling is possible only by observing labor discipline. Socialist labor discipline at the plants is included in the strict observance of:

- 1) The established work day routine, that is, punctuality in reporting for work, full utilization of work time during the shift period, and the adherence to rules for internal order;
- 2) The established technological routine and production instructions, that is, carrying out processes according to regulations, fulfilling work quality indicators, and maintaining output of high-quality products;
- 3) The principle of one-man management, that is, the responsibility of workers to their supervisor and each worker's personal responsibility for the work entrusted to him.

Labor discipline also includes care of State property, equipment and materials.

Encouragements have been established in the USSR for outstanding work achievements, for conscientious work, for honest and irreproachable fulfillment of duties. These encouragements are expressed by the conferring of honorary titles for being an "outstanding worker in socialist competition," "best worker in a particular trade," and by the awarding of decorations and medals for selfless labor.

The Decree of 20 December 1938 of the Presidium of the Supreme Soviet of the USSR established the highest order for labor excellence -- the title of a Hero of Socialist Labor, and established awards "For valor in labor" and "for excellence in labor."

It is not sufficient, however, in strengthening socialist labor discipline just to use measures of persuasion and encouragement. Measures of constraint and punishment should be used against individuals who break labor discipline at enterprises.

The person who is late for work without a valid excuse, who leaves early for lunch, who is late in arriving from lunch or leaves work early, is punished by the administration; he is rebuked, a reprimand is published -- a strong reprimand, -- he is transferred to other, lower-paying work for a period up to three months or removed permanently to a lower position.

The administration has the right to dismiss this worker if he continues to violate labor discipline.

Disciplinary action is imposed by the plant administration immediately after violation of labor discipline, although before the imposition of a reprimand an explanation should be requested from the violator of labor discipline. The reprimand is published throughout the plant, the worker is notified and a receipt of notification is obtained from him.

#### Organization of the Work Areas

The proper organization of the work area and its maintenance in good order is one condition for highly productive work.

Assignments of personnel to work areas should contribute to the proper execution of the production process and to thorough care of equipment operating under full work day loads and to the full utilization of workers according to their qualifications.

Workers' duties should be clearly defined. Each one is assigned a particular work area and he is entrusted with the servicing of particular equipment, the execution of certain processes or functions. Auxiliary workers, craftsmen of the shop maintenance crew, are assigned equipment which they maintain and repair.

The worker may be permitted to do independent work only after a thorough test of his knowledge of the technological process and of the rules and measures for industrial safety, provided in the instructions. Proper leadership of workers must be organized, based on the systematic training and instruction of workers.

Raw materials, supplies and intermediate products must be supplied to the work area uninterruptedly and uniformly. In a large measure, this may be promoted by mechanization of the delivery of raw materials, their loading into the apparatus and their unloading.

The work area must be equipped with controlling and measuring as well as regulating devices -- thermocouples with galvanometers, potentiometers, gas-analyzers, pressure- and temperature regulators, and others. These controlling and measuring devices should preferably be placed on a special panel, conveniently located, so that the worker can watch a number of them at the same time. The organization of communication and signals between work areas in chemical production also has important significance because of the sensitivity of the response of chemical processes to violation of technological regimes and the dependence of a number of operations upon each other, particularly under conditions of continuous production.

The following means of communication are used:

- 1) Telephone -- with the personnel supervisor (the engineer or foreman) and with the maintenance crew.

2) Vocal -- with adjacent work areas in order to receive necessary information on loads, analysis data and such (this is used most frequently when equipment is several levels high).

3) Vocal or with lights -- to warn of loading and unloading, or of interruptions of routines.

There should be sufficient quantities of necessary instruments and devices in the work areas, which must be arranged in specific order (in special cabinets or on shelves). At the same time, there should not be any superfluous or unnecessary devices for the performance of operations in the work area.

In socialist industry, considerable attention is paid to the creation of necessary sanitary and hygienic conditions for ensuring the protection of workers. Consideration for workers in production is a most important task for plant managers and departments. Every illness caused by working conditions, every accident on the job should be carefully investigated so that measures can be taken for their prevention.

Efficient organization of functions based on mechanization and automation of production removes the necessity for workers to come in contact with chemical raw materials and products, that is, it contributes to greater safety at work and to sanitary working conditions. Timely execution of sanitary measures -- ventilation and shower facilities, dehumidification or humidification of air, the use of comfortable and protective work clothing, the use of automatic analyzers and regulators of the routine's parameters (loads, temperature, pressures) -- create safe working conditions.

Every work area should have an established routine for the changing of shifts.

When starting his shift, the equipment operator must check the airtight conditions of the apparatus and its fittings and for proper ventilator settings. He must check the temperature and pressure of the apparatus and receive from the equipment attendant being relieved, all detailed information concerning the work of the preceding shift, and troubles and peculiarities in the operation of the apparatus.

When going off the shift it is necessary to observe the same routine, as when starting the shift.

When taking over his shift, the worker should arrive at work early, so as to make the rounds of the apparatus to be attended by him before the shift starts and to check its functions while it is in operation. Thus, before starting his work, the equipment attendant familiarizes himself fully with production conditions in the shop.

Starting his shift and knowing the condition of the assemblies, the equipment attendant maintains the established routine or regulates the equipment, starting with the assembly which is most im-

portant for maintaining the output and quality of production.

At every work area it is necessary to:

- 1) Maintain cleanliness and order; prevent the overflow of products used in production.
- 2) Maintain in perfect order the controlling and measuring devices and accessories.
- 3) Immediately notify section leader or senior attendant of any air leaks in the accessories.
- 4) Notify the controlling and measuring-device monitor on duty in the shop or the shift supervisor of incorrect registrations of the devices and of defects in the automatic regulators.

#### Complex Organization of the Work Area

Complex organization is that type of organization of the work area under which, based on the experience of production peredoviks (outstanding workers), all conditions for highly productive work are carried out.

The movement for perfection of the work area based on its complex organization began at the Kauchuk plant at the initiative of N.S.Yushin, a gluer in a hose shop, and L.N.Shcherbakov, his assistant (Note: I.Manvelov, Word and Deed, "The Moscow Worker", 1958, page 25). These workers discovered means of increasing labor productivity at the glue-assembly of hoses and together with the engineering personnel of the plant developed measures for the complex organization of the work area.

The realization of Yushin and Shcherbakov's suggestions for lengthening the gluing table from 13 to 23 meters permitted the use of mandrels or poles 20 meters long (instead of four to nine meters) and, instead of the usual two lengths, to assemble five hoses simultaneously, each four meters long. Using a self-centering chuck for gripping mandrels, or poles, the production innovators increased the rotation speed of the roll-up head from 190 to 240 revolutions per minute. The production of metal spirals (components of the hose) was switched onto a spiralling machine, and up to 45 minutes of assemblers' work time was freed for the performance of the main operation.

The list of basic measures for improving equipment in the work area of hose-gluer Assemblers, developed by Yushin and Shcherbakov, is outlined in Table 2.

Table 2  
Complex organization of the work area for gluer-assemblers

| Elements of complex organization                                  | Before complex organization of the work area | After complex organization of the work area   |
|---|--|---|
| <b>I. Utilization of equipment and production area capacities</b> |  |   |
| Length of gluing table, m.  | 13   | 25  |
| Length of pipe, on which hoses are assembled, m.                  | 4 or 9                                       | 22  |
| Revolving speed of roll-up head, r.p.m.                           | 190  | 240   |
| <b>II. Organization of the work area</b>                          |  |   |
| Supply of tools and devices, pieces                               | 17   | 30  |
| Auxiliary supplies, pieces  | 5  | 7   |
| Lay-out of the work area  |  | Shelves for pipes were placed at the gluing table, racks were built for storing intermediate products and tools, lighting was improved. |

|  |   |  |
|--|---|--|
| Supplying the work area                                    | Time wasted during shift changes because of untimely feeding of materials and intermediate products -- 12 minutes | Schedule of delivery introduced for materials and intermediate products. No time wasted. |
| Maintaining cleanliness and order in the work area         | --  | Instructions set up for the care of the work area  |
| <b>III. Introduction of improved operations</b>            |   |  |
| Glue-assembly of hose 4 meters in length                   | 2 hoses simultaneously  | 5 hoses simultaneously   |
| Time expended in mounting 1 linear meter of hose, sec.     | 67  | 34   |
| Time expended in fluing operation on 1 meter of hose, sec. | 59  | 42   |
| * Time expended in switching to laying loose spirals, min. | 45  | Gluer is freed of spiral laying  |
| Applying of fabric lining                                  | 20  | 10.2   |
| <b>IV. Distribution of functions between crew members</b>  |   |  |

Time expended  
in bandaging 59 (done by crew  
1 meter of hose (done by crew  
in calico bandage leader)  
ges and lacing  
up hose, sec. 29 (done by crew  
leader and his  
assistant)

V. Quality of  
manufactured  
products

First grade, % 97 100

Rejects 0.1 none

VI. Economy of  
raw material.  
Rhythm of work

Economy of raw  
material and No individual crew Individual accounts  
supplied accounts organized

Rhythm of work No hourly schedule Hourly schedule  
introduced

As a result of the complex organization of the work area, labor productivity of the workers in Yushin's brigade rose by 40%.

Complex organization of the work area is effected after a thorough analysis of organizational and technical requirements for the specific work area -- and analysis of processes, existing service systems and other factors having an influence on labor productivity.

As a result of the analysis of all of the factors and examination of submitted proposals, a new, more perfected plan is created for the organization of labor at work areas. This plan is considered at production meetings of workers in the same occupations. The concluding stage is the setting up of work schedule chart and its approval by the plant director. This is displayed in the work area and is familiarized by every worker. If necessary, classes are organized for mastering of new work methods.

#### Physiological Labor Conditions

The best physiological labor conditions should be created at work areas.

In studying, for instance, the work process at the "Red Triangle" plant, the opportunity arose to improve the organization of the work areas at the production line fore the assembly of galoshes [Note] Physiological Streamlining of the Work Area and Motions, Leningrad Order of Lenin State University publishers, Imeni A. A. Zhdanov, 1950).

It was established that the stools then used (Fig.4) had to be replaced. The stools did not have backs, and workers strained their backs and abdominal muscles, although, in many cases the workers could have worked while leaning against the back of a chair. The round seat of the stool, 38 centimeters in diameter, and slightly concave in the center, induced unnecessary straining of pelvic and thigh muscles. The chair construction, shown in Fig. 5, turned out to be more comfortable.

It was established that in order to work while sitting it was necessary to provide rests for the feet in the shape of special platforms of various heights (depending on the height of the workers) with an incline toward the worker so that the sole of the foot would be somewhat higher than the heel. When using a glue jar 20 centimeters in height it was necessary to raise the hands high. This was obviated by "sinking" the jars into the table so that they protruded not more than 5 - 7 centimeters.

Investigation showed that workers made unnecessary motions at nearly every operations which could be eliminated with some improvement of the work area.

Thus, for instance, the operation "tightening the lining on the colored insole, roll-up and measure" requires skilled and energetic motion of the fingers of both hands. But since both hands of the worker were occupied, she pressed the last to herself, resting the heel against her stomach. Some workers, in order to steady the last, bent forward and assumed an uncomfortable position (Fig. 6). In order to draw the lining with her fingers, while her body was bent forward, the worker was obliged to make additional motions with her wrists. Thus, the unsteadiness of the article as it was being made led to unnecessary fatigue and poorer workmanship.

Production innovators suggested fewer motions during the tightening; they did the work mainly with the help of the wrists (Fig. 7).

For the efficient execution of this specific operation it was suggested that a rest be built for the heel of the last, at the edge of the table and that the horizontal work surface be replaced with a surface inclined toward the worker (Fig. 8).

As a result of the thorough study of operations at the production line, the workers' fatigue was reduced and labor productivity was increased.

The proper alternation of work and rest periods has an important bearing on reduction of fatigue at the production line. A suitable work and rest routine should be established in each specific case. It was shown in practice that use of two rest periods was most effective; the first during the first half (pre-lunch) period of the work day, and the second during the second half (after lunch) period of the work day. The rest period had to be active (the workers performed light physical exercises during the period). In conjunction with these active rest periods (physical culture pauses) it is advisable to have a five-minute period for gymnastics at the start of the work day.

The practice of having five-minute gymnastics and physical-culture pauses during production-line work which is being done at a certain rate has shown that this keeps workers' efficiency at a high level for the duration of the work day. It is more expedient to have the active rest periods right in the shops, at the work areas. However, it must be kept in mind that the active rest periods cannot be held in shops with high humidity, high temperatures, dust, and also in the presence of harmful chemical substances in the air. In such cases it would be necessary to organize active rest periods in other premises, and outdoors in the summer whenever possible.

e) Care of the work area

At the start of work (beginning of the shift):

- a) Check the work order and cleanliness of the refining rolls.
- b) Acquaint himself with the routine working condition of the equipment, paying particular attention to the temperature of rolls and their surface condition, as well as bearing temperature.
- c) Acquaint himself with peculiarities and deficiencies in the operation of the equipment.
- d) Check the working condition of the automatic emergency switch.
- e) Check the availability of the tools, and their working condition.
- f) Acquaint himself with the present status of incompletely completed work left by the worker whose shift he had just relieved.
- g) Check the thickness and width of the removable rubber sheet. Notify the foreman of any deficiencies.
- h) Obtain small gauge wire cables, knives, talc, chalk, sacks for fines, wiping materials, and lay them out in order in the work area.
- i) Receive orders from the foreman indicating the batch and type of rubber to be processed.

During the operation:

- a) Strictly observe the established work routine.
- b) Maintain order and cleanliness in the work area. Make sure that the floor around the refiner is always dry and clean, so that foreign substances do not fall into the tray (pan).
- c) Prevent damage to equipment and implements. Frame of the refiner should be wiped dry with rags soaked in kerosene.
- d) Clean the drip-pans under the bearings and wipe them dry.
- e) Clean out pieces of rubber from the drip-pan under the rolls.
- f) Sprinkle the tray for cuttings with talc.
- g) Make sure of a supply of raw material of the shelves.

All malfunction in equipment operation should be immediately reported to the foreman.

At the end of work (end of the shift):

- a) Bring to order the stocks of materials and the working parts of the rolls, tools and implements.
- b) Clean out drip-pans under bearings and rolls. Collect rubber fines into a sack.
- c) Do Not leave work area until arrival of replacement.
- d) Give all necessary work information to replacement.
- e) Turn over work area, in perfect order, to replacement.

III. The Process

| Operational Conditions                          | Method of Control  | How to Regulate   |
|---|--|---|
| Temperature of Rolls                            | Periodic checks with a thermocouple (done by a worker of the technical control division) | By changing the water feed into the cooling jackets of the rolls          |
| Sheet Thickness                                 | Measure sheet thickness with a micrometer or by visual inspection                        | Setting gap distance between rolls  |
| Presence of hard inclusions in technical rubber | Examination of sheets from industrial batches  | By moving the edge-cutting knives, and also setting the gap between rolls |

IV. Possible Troubles and Means for their Elimination

| Troubles                                     | How to discover | What operator must do                                      |
|--|-----------------|--|
| Foreign bodies falling onto the rubber rolls | By observation  | Push lever of emergency switch to stop machine immediately |

|                     |                     |   |
|---------------------|---------------------|---|
| Rolls overheating   | Scorching of rubber | Increase the water feed into the cooling jackets of the rolls |
| Bearing overheating | By touch            | Immediately notify the greaser                                |

#### V. Servicing of the Production Work Area

| Who services            | Duties  |
|-------------------------|---|
| Shop foreman            | General supervision of work and taking measures for the elimination of troubles   |
| Conveyor loader         | Unloads raw rubber from moving conveyor onto shelves at the refiner   |
| Maintenance man on duty | Watches equipment and determines defects in its operation. Maintains equipment in proper condition by making small repairs  |
| Greaser                 | Checks for presence of oil in lubricators, fills lubricators, regulates oil feed for automatic lubrication. Watches temperature of working parts of mechanisms and their lubrication. |

#### VI. Industrial Safety Measures

It is absolutely forbidden to press rubber by hand when the rubber is between rolls, and also to reach for anything that may have fallen into the clearance gap while the rolls are rotating.

To avoid accidents while working, tie the ends of sleeves and tuck in clothes. Work only in overalls that are in good condition.

Chapter Six: Four

## Chapter Four

### TECHNICAL STANDARDIZATION

#### 1. Basic Problems of Technical Standardization

Proper technical standardization is the basic means for labor and wage administration at enterprises; it provides for growth in labor productivity and promotes the development of socialist competition.

Technical standardization should be understood as the study of existing organization of labor and the establishment of more progressive labor organization of workers based on the generalized experience of peredovik workers in production and estimates of production potentialities, and also based on progressive technical time standard units and standard time task units of the output.

Standard Time:Unit: The amount of work time (in man-hours, man-minutes) which must be spent on one unit of production (tons, pieces, etc.) with more efficient use of equipment and application of advanced work methods.

Standard Time Task Unit: Quantity of production (in tons, liters, meters, pieces) which must be produced by workers (or brigade of workers) in one unit of time (hour, shift) under conditions which have been defined when time standards were established.

The output rate of a shift is determined by dividing the length of the work shift by the time standard set for the output of one unit of production:

$$N_{out} = \frac{P}{T}$$

where  $N_{out}$  is the output rate for the shift;

$P$  is the length of the shift, in minutes;

$T$  is the standard time unit for output of one unit of production in minutes.

Standard time units and output rates must have technical justifications. When establishing standards and rates it is necessary to have the following conditions:

- 1) Presence of an efficient technological process and proper work scheduling peculiar to some specific production;
- 2) Fulfillment of task by workers with appropriate qualifications on a level of productivity higher than the average pro-

ductivity of workers in similar jobs, and corresponding to the constant indicators of peredovik workers (but not to individual record achievements);

3) Normal sanitary and hygienic conditions in the work area (lighting, cleanliness, temperature, ventilation, and the like) and observance of industrial-safety rules;

4) Organized servicing of the work area with all that is required for uninterrupted work;

5) Fuller utilization of work time using experience of peredovik workers.

In establishing technically justified norms, it is advisable to consult with highly qualified workers, peredoviks and production experts; their suggestions will contribute to the perfection of methods in the execution of rated operations and to correct determinations of the amount of labor allowed.

When developing technically justified standards, the foreman (shift supervisor) should take an active part since he is the direct organizer and leader of a production section. The foreman (shift supervisor) supervises the supply of the work areas with all that is necessary for uninterrupted work and trains the workers in the execution of operations in accordance with the requirements of the technological process and with those methods and work applications which were provided by the established standard.

Technically substantiated standards are developed by workers in the shop together with workers of the labor department (planning), after which they are approved by the plant director.

Rate setters and foremen (shift supervisors) must, after the introduction of new rates, strive for complete realization of working conditions as provided by standards and to render timely assistance to workers in fulfilling and exceeding rates.

Despite the advanced nature of technically justified rates, a number of enterprises use understated, so-called empirical statistical norms of output which do not correspond to the present level of development of equipment and to advanced production engineering.

Empirical statistical norms, based only on the rate setters' (foreman's) personal experience or on reported facts concerning earlier achievements in average output, are faulty because they include losses of work time incurred during the interruptions and down-time, and do not take into account the perfection of production. The exceeding of such rates creates an atmosphere of false well-being at the enterprise, induces complacency and weakens the battle for further increases in labor productivity.

The July (1955) Plenary Session of the CC CPSU made it mandatory for department supervisors to provide for the wide appli-

cation of technically substantiated output rates in the enterprises, corresponding to the present level of equipment development and production engineering.

The existing work scheduling and working methods of production experts are studied while they are in action, for technical rate setting purposes, by the analysis of the working day and by time study. Analysis of the work day is done over the duration of the entire shift in order to discover losses in work time, deficiencies in servicing of work areas and in working conditions. Time study serves to determine the speed of accomplishment with individual work methods.

In order to compute technical standard time units (output rates) both methods are used in the study of work time.

## 2. Types of Production Processes

Production processes in the chemical industry are distinguished by their great variety, and even up to now there is no fully established classification.

When setting up technical standards, the processes are divided into the following basic categories:

- 1) Apparatus (unit process);
- 2) Machine (unit operation);
- 3) Apparatus and manual process;
- 4) Machine and manual process;
- 5) Manual process.

The apparatus category includes such chemical and physico-chemical processes as, for instance, reduction, oxidation, neutralization, sulfonation, electrolysis, electric furnace melting, and dissolution.

These processes are executed mainly by regulation and control, by watching the course of processes according to established time limits.

In chemical production it is necessary to differentiate between apparatus processes that are continuous and those that are interrupted (periodic processes).

Among the continuous apparatus processes, reagents, after entering the apparatus, are in continuous interaction; reagents are loaded and reactive products are tapped either continuously or periodically, but without stopping the operation of the apparatus.

Such processes include, for instance, the production of sulfuric acid, nitric acid, ammonium nitrate, butyl alcohol, synthetic rubber, hydrochloric acid and soda ash.

In the interrupted apparatus processes materials are loaded and products are unloaded periodically; at these instances individual stages of production are started and completed as they flow successively through the apparatus. These include, for example, production processes for paints, enamel, superphosphate, barium, sulfate, alumina, calcium chloride and phosphorite fertilizer.

The continuous processes, in comparison with the periodic processes, are more perfected. They are characterized by:

1) Opportunity for complete automation and mechanization, which contribute to increased productivity and decrease the application of manual labor;

2) Extraction of a homogeneous product and, consequently, improvement in its quality;

3) Compact equipment, which leads to reduction in capital expenditures and maintenance expenses.

Because of these reasons, all branches of the chemical industry are widening the application of continuous production processes.

Machine processes are those that receive mechanical treatment, relating to changes in form, external appearance, dimensions or material state which is accomplished with the help of machines. The role of the attendant is to watch the machine's work, regulate and maintain it; in some cases, also to periodically load and unload the machine. These processes include, for example, the crushing of pyrites in mechanically fed crushers, calendering of rubber in calenders, and oiling of calender fabric.

Apparatus and manual processes are those in which the actual physical and chemical processes in the apparatus alternate with manual labor — the functions of the attendant. For example, during centrifugation these operations alternate: loading the centrifuge (hand operation), centrifugation apparatus process), unloading of product (hand operation). Filtration processes also have the same sequence.

Machine and manual processes are those that are related to changes in form, state or condition of materials being worked upon, accomplished by a machine with the direct participation of the attendant. In this case the productivity of the machine is directly dependent on the attendant's actions. These processes (functions) include, for example, crushing of raw materials in hand-fed crushers, shaping rubber components in presses and machines, and cutting of rubber with guillotine knives.

Manual processes are those that are performed by workers without the application of mechanical means and directed primarily at changing the location of materials or altering their form. These processes (functions) include, for example, sorting of articles, packing of different types of finished products, and equipment repairs.

The processes are subdivided for servicing between individuals and brigades, depending on the number of participants at work at the same time.

In the individual servicing process the attendant independently services one or several apparatuses (machines). For example, one equipment technician services three catalytic furnaces or 15 polymerizing vessels; one press operator - two presses.

Because of the character of team work, the group of attendants, dependent upon each other in the work process, service one or several apparatuses (installations) simultaneously. For example, the carbide furnace is serviced by a brigade of seven men; the whole apparatus of a sulfuric-acid shop is serviced by a brigade of six men (in one shift).

### 3. Breakdown of Production Processes into their Component Operations

The production process is the sum total of diverse, mutually interdependent technological and labor processes, which result in the conversion of raw materials and intermediate products into the finished product.

The direct labor process is the influence of the worker upon the object of his labor; the execution of certain labor activities, active supervision over tools of production and control of the operational flow. Physical and mental efforts are combined in the labor process.

The production processes are subdivided into specific, successively smaller component parts; operations, phases and methods.

The periodic apparatus processes are performed in the form of successively renewable production operations, concluding in the extraction of certain quantities of products from the apparatus.

The length of the production operations, beginning with the loading of the apparatus, including the flow of chemical reactions or physicomechanical treatment of materials, and ending with the unloading of products from the apparatus, constitutes the length of the process-turnover of the apparatus.

The execution of production operations is tied in with the performance of specific functions, in the conveying of materials and their loading into the apparatus, cleaning of equipment, unloading of products from the apparatus, etc. All these functions are called phases or elements of the operation.

To execute an element of an operation a number of separate methods are applied -- separate completed activities having, as their goal, the regulation of one production factor or another.

When necessary, separate methods may be subdivided into operations including either the point of contact between the worker and product, or the worker's movements from place to place (with or without the product).

In the standardization of chemical production processes it is sufficient to break down processes into operations.

Since the lengths of all elements of an operation determine the length of the whole operation, and the lengths of all operations -- the length of the whole production process, all stages of the production process must be subjected to a thorough analysis when establishing time standards for time allowed for the execution of the process.

The breakdown of a periodic production process into its partial processes, operations and procedures can be shown in the following examples.

Production of steering wheels made from plastic includes two production processes: extraction of etrol and the making of steering wheels.

Each of these processes consists of a number of operations. Thus, the process for making steering wheels consists of three operations: molding, trimming, and polishing (Process Chart I).

The trimming operation consists of five successively executed motions.

The production process for extracting Ash-acid (Process Chart II) is made up of 14 operations, each of which consists of a number of phases. The operation for sulfonating naphthalene includes 18 phases. Each phase consists of a number of successively applied procedure. The naphthalene-feed phase is made up of seven operations.

Process Chart III shows the breakdown into component operations of the continuous production process in the manufacture of sulfuric acid.

The study and analysis of factors influencing the length of each operation of the process make it possible to establish efficient routines for the production process and for proper work scheduling.

This study is effected by observing the work of peredoviks, accompanied by an analysis of their achievements -- revealing individual work habits of highly productive workers, general methods of work scheduling and best ways for performance of operations available to most of the workers.

When studying separate elements of the production process particular attention must be paid to the revealing of organizational and technical troubles which disturb productive work, and to the discovery of ways to decrease time expended on separate elements.

When analyzing manual, machine-and-manual, apparatus-and-manual processes some means for their mechanization should be developed.

#### 4. Analysis of Allowed Work Time

An analysis of allowed work time shows that there are productive periods and non-productive periods.

Productive periods are those during which the worker does his work, which is necessary for production output.

Workers' non-productive periods, or time losses, are interruptions during the work day caused by organizational and technical troubles.

With the help of technical standardization it is possible to discover and measure all types of work-time losses in the production process, to determine reasons for work-time losses and develop necessary measures for their liquidation.

##### Analysis of Allowed Time of the Operator

In an analysis of allowed work time of the operators, the work time and idle periods are differentiated.

Work time is subdivided into preparatory and clean-up, main, auxiliary and incidental periods.

The preparatory and clean-up period is time expended by the operator in the preparation of the work area before he begins the operation (accepting the shift, putting on protective gear, receiving orders from the foreman concerning pending work, examination and preparation of apparatus, washing and warming of apparatus and lines checking the condition of controlling and measuring devices) and in bringing the work area to order after he completes his work (cleaning the work area, removing protective gear, and surrendering the shift).

The peculiarity of this work period is that its extent, as a rule, does not depend on volume of work provided by the production assignments.

The main period is the time expended by the operator in the direct performance of the technological process, that is, changing forms, dimensions, structures, chemical composition, temperature and other properties of substances in accordance with the requirements of a specific production process.

In the apparatus processes, the activities of the operator are related to the main period in his regulation of the process, his control of the inflow and outflow of reagents and by-products, the maintenance of control-and-record books and active supervision over the process flow.

The auxiliary period is that time spent by the operator in creating conditions for the performance of main function (mixing raw

materials and making adjustments while working within the limits of a specific work area; filling up hoppers and other auxiliary apparatus; selecting samples, making analyses, and the like). If the personnel includes a helper, then the filling of hoppers and other similar work will be that worker's main functions.

The allowed work time in the fulfillment of auxiliary preparatory and clean-up functions should be kept at a minimum; if possible, these functions should be delegated to auxiliary personnel.

The operator's activities, related to his work, that are not covered by work instructions and which are the result of unsatisfactory work-area organization (troubles in the operation of equipment, usage of below-standard raw materials, insufficiently qualified operator) belong to the incidental period. Incidental periods are subdivided into those that result from the worker's actions and those that are the result of organizational and technical reasons.

Included in the incidental periods resulting because of the worker's actions are, for example, such actions, forbidden by work instructions, as overheating apparatus and letting mixtures cool; this occurs when the worker is not sufficiently qualified or when he does not follow the established routine.

Included in the incidental periods that are the result of organizational and technical reasons are the worker's actions related to the unsatisfactory servicing of the specific work area (in the delivery of raw materials to the main operation of the conveying of finished products, unnecessary delay in production because of the absence of specific laboratory analysis, and having to perform work by order of the administration which is not included in the worker's normal duties).

When analysing allowable work time, incidental work is completely excluded; simultaneously, methods are developed that will prevent the re-occurrence of such work.

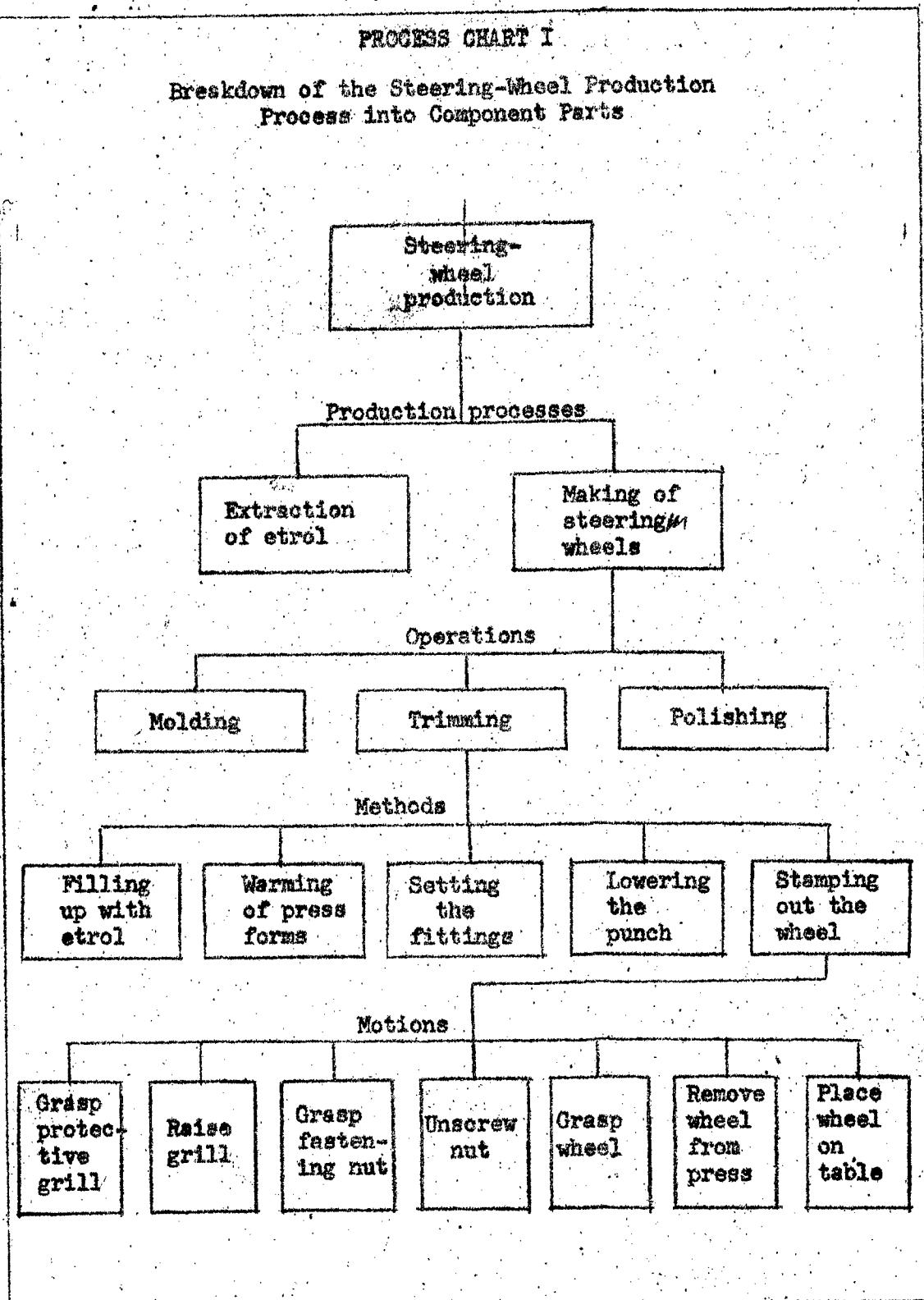
During the analytic classification of allowable work time in automatic processes, the allowable work time of the operator is subdivided into periods of physical and regulatory functions, maintenance of a control and record book (observations) and movements from place to place.

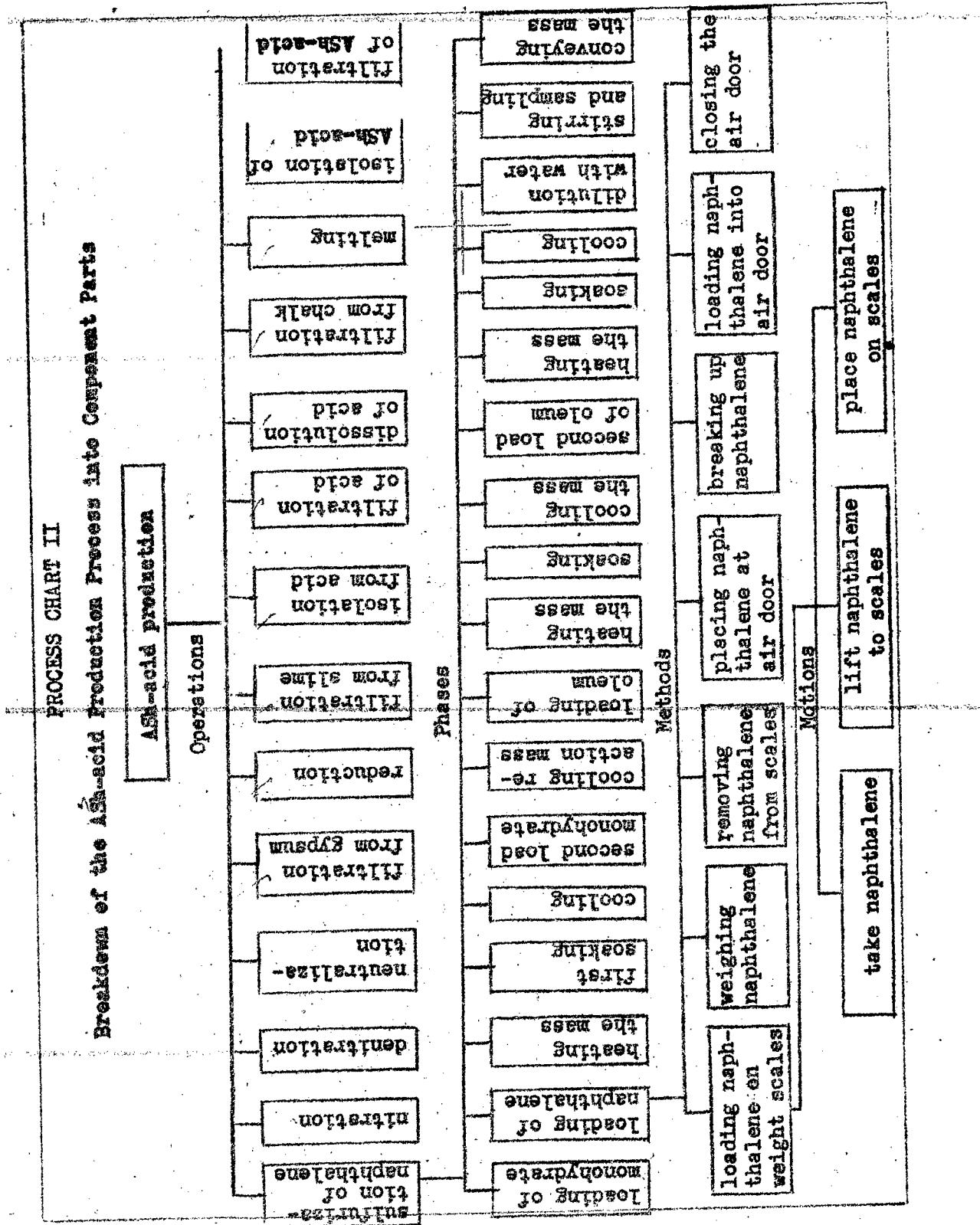
Manual work includes functions of the attendant in the un-mechanized loading of apparatus, unloading of products and the like.

Control-record book maintenance and regulatory functions include watching indicators of control measuring devices (areometers, manometers, pyrometers, etc.) and making adjustments in the process in accordance with observed data; maintenance of accounts relating to the execution of the process; recording information on process flow in a journal; measuring volumes and concentrations of reagents; controlling regulating devices (opening and closing cocks, globe valves, gate valves, and other similar operations).

### PROCESS CHART I

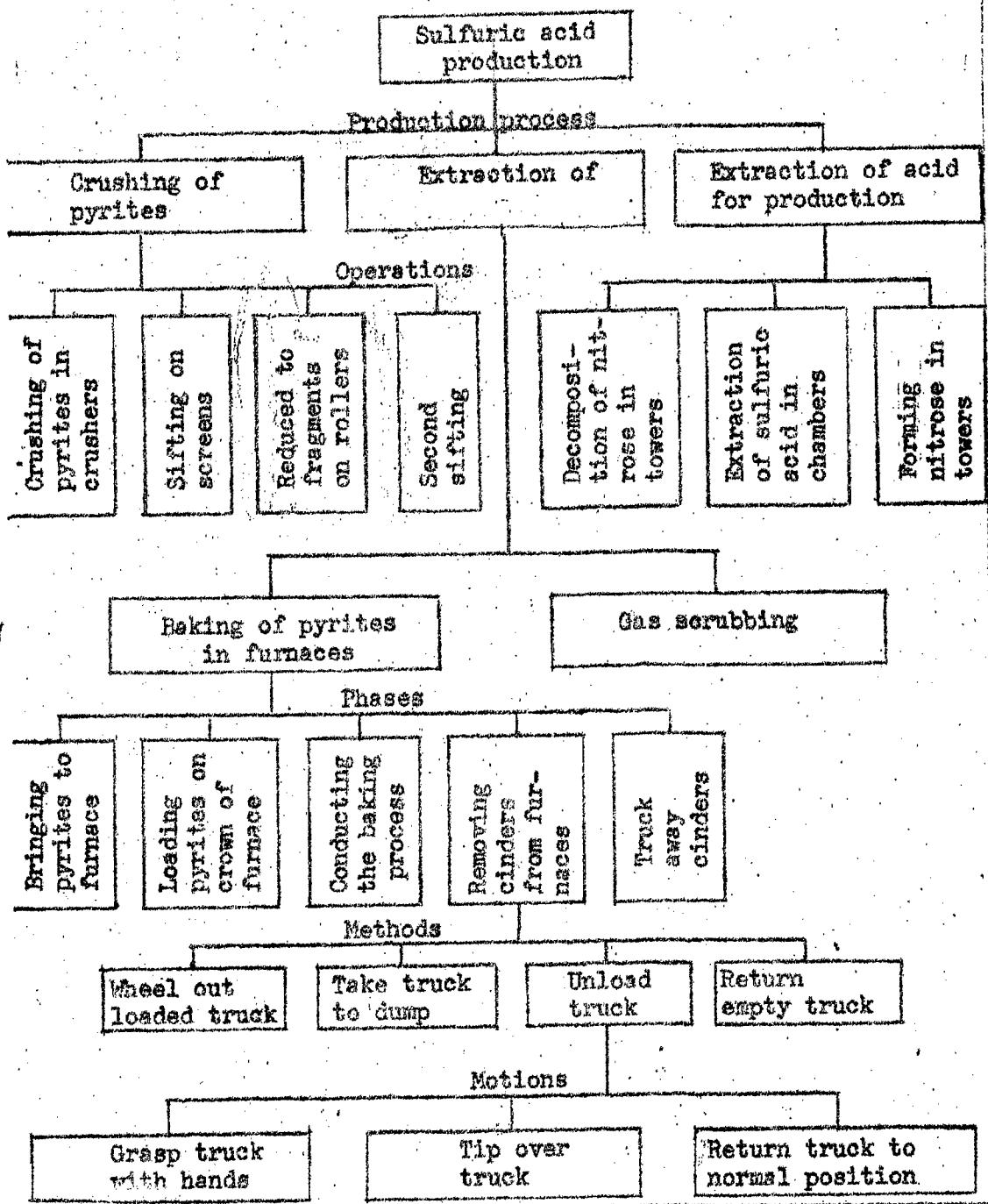
#### Breakdown of the Steering-Wheel Production Process into Component Parts





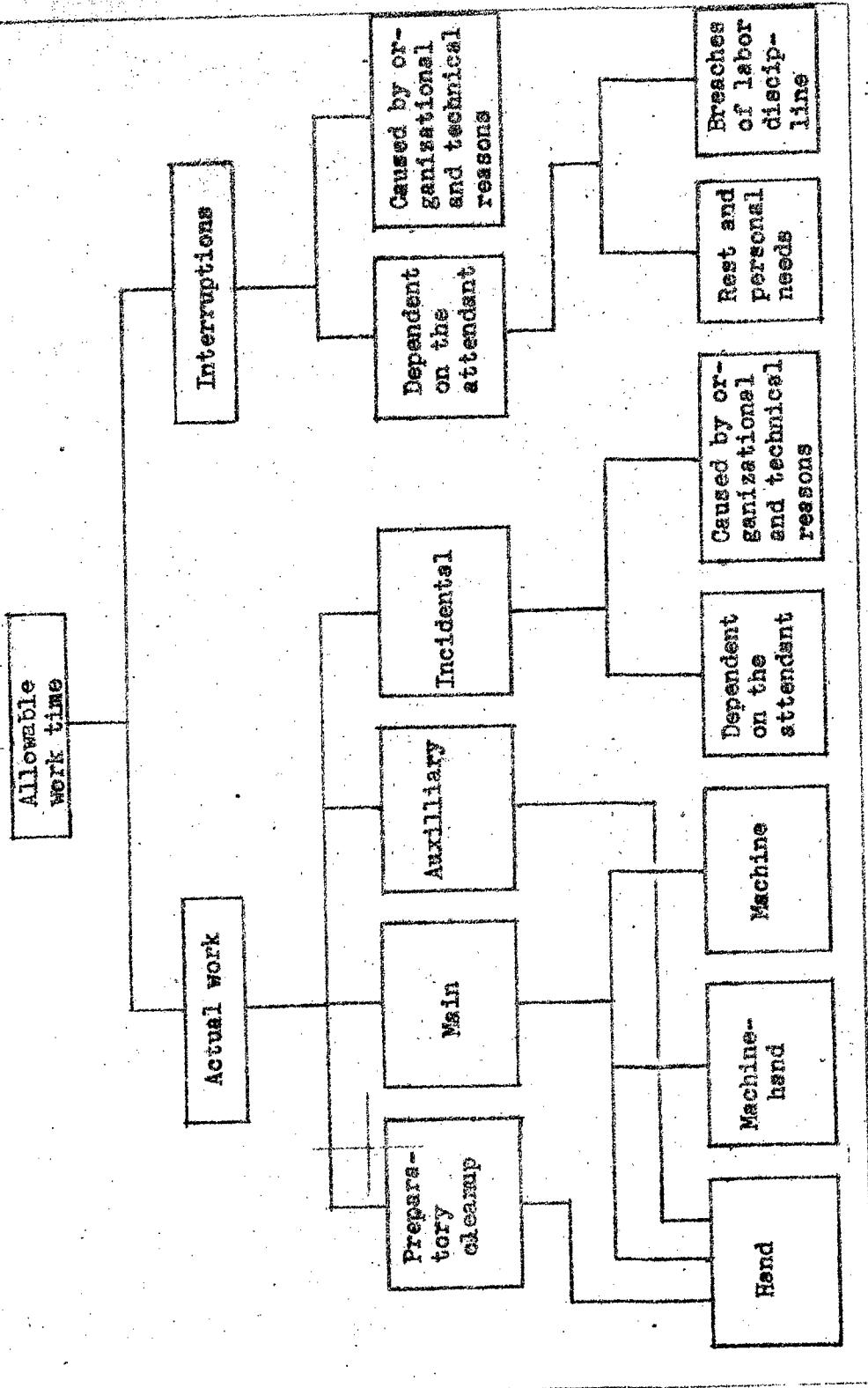
PROCESS CHART III

Breakdown of sulfuric acid production process into component parts



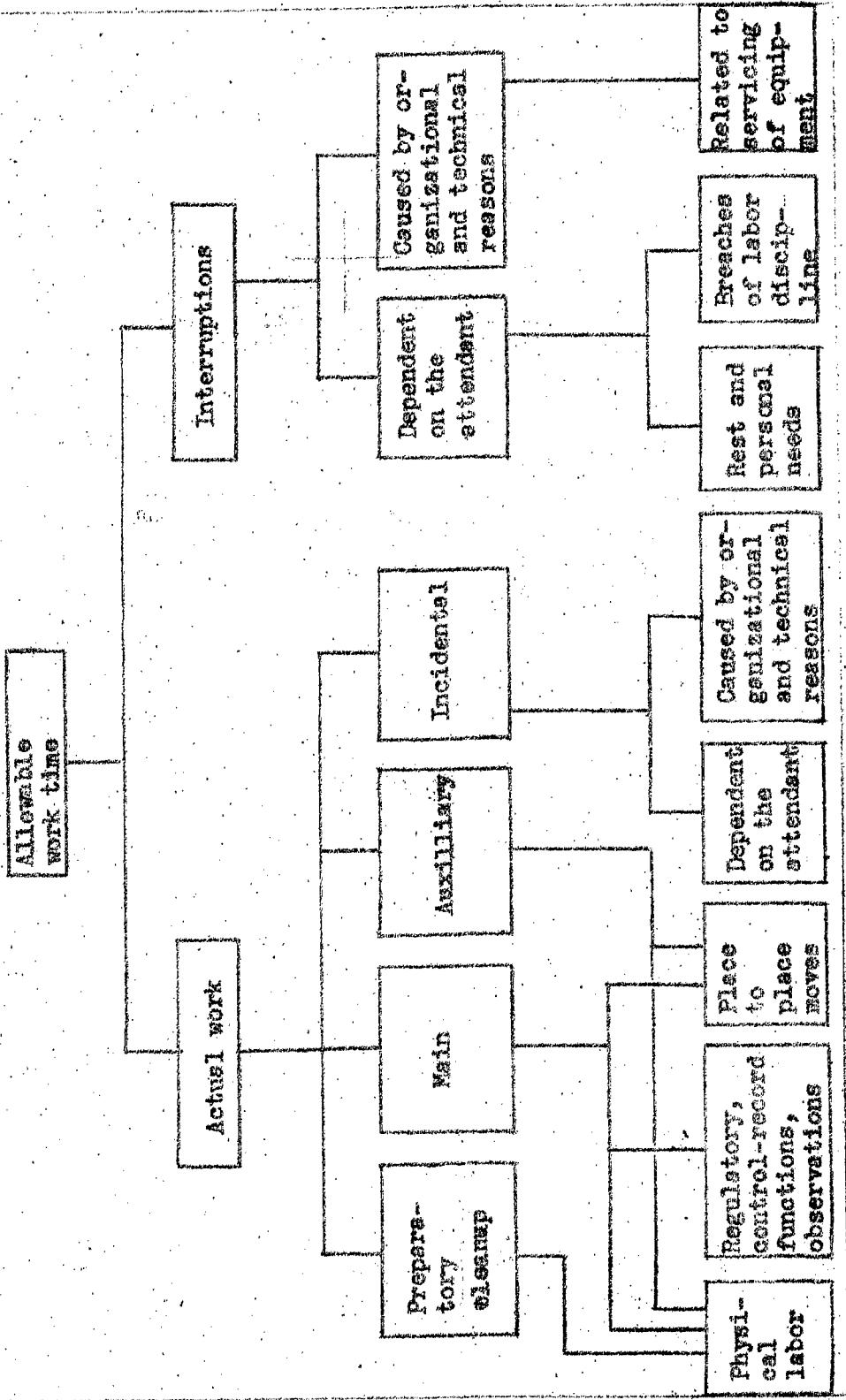
PROCESS CHART IV

Analytical classification of allowable work time in manual and machine-manual processes.



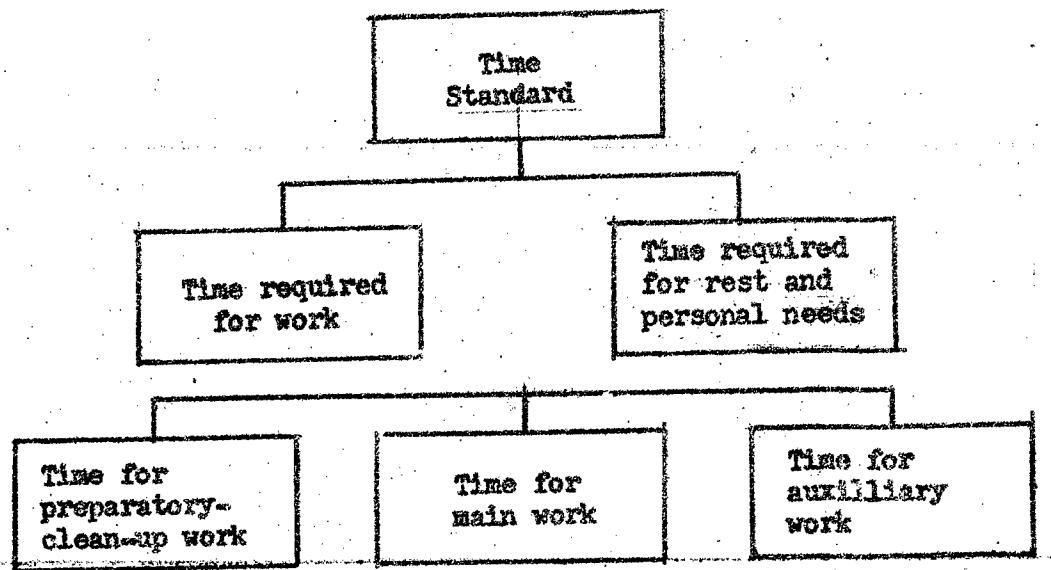
PROCESS CHART V

Analytical classification of allowable work time in automatic processes.



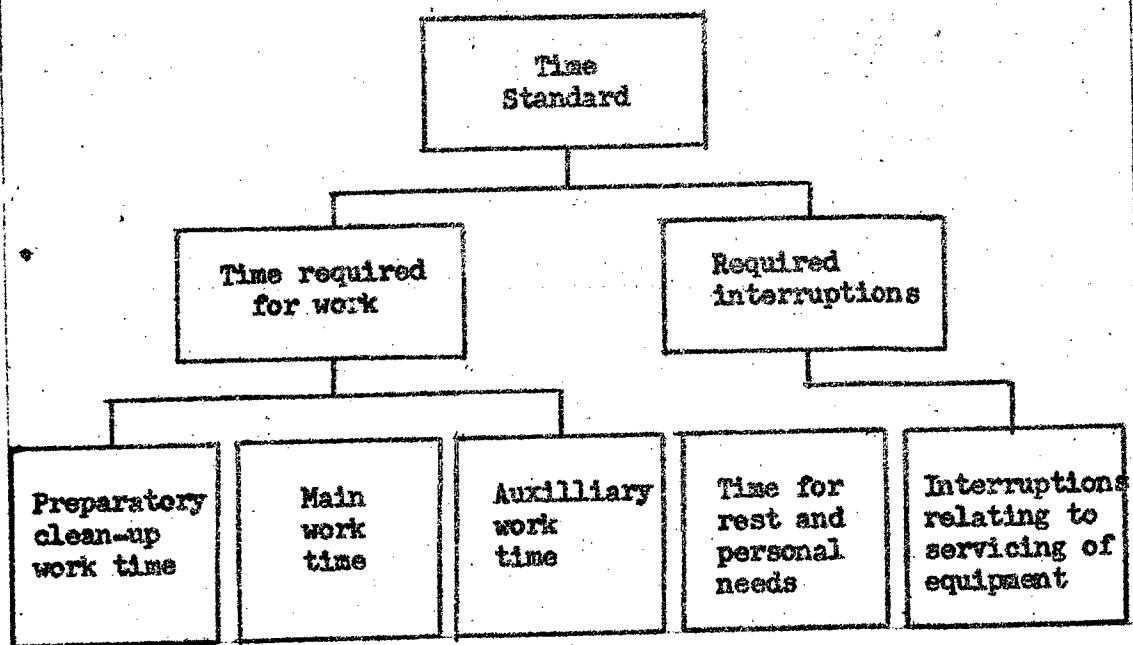
#### PROCESS CHART VI

Normal composition of operators work time in manual and apparatus and manual processes



#### PROCESS CHART VII

Normal composition of operators work time in apparatus processes



Movements include the attendant's walking from one apparatus to another, from one flow to another, or from one department to another, all of which are related to his duties in the servicing of a specific work area.

When analyzing allowable work time it is most important to find a way to overlap separate work method periods (carry out an analysis, for example, of hand methods simultaneously and parallel with the mechanical and apparatus operations). As a result, the allowable time in work performance will decrease, and it will become possible to attend to a large number of apparatuses.

When analyzing allowable work time in manual work, particular attention must be paid to mechanization possibilities.

Interruptions are subdivided into those that result from the attendant's actions caused by organization - and technical reasons and those related to the servicing characteristics of the apparatus.

Interruptions resulting from the attendant's actions include: rest periods, tardiness at work and delays in the dining-room. When analyzing time expenditures at rest periods, factors that induce fatigue in workers are studied; the utilization of rest periods by production peredoviks during the course of the work day is studied; and measures are taken to decrease fatigue and to establish necessary rest periods. If these determined rest periods actually exceed the number already established by standardization, then this extra interruption time is not included in the time standards. Interruptions because of breaches of labor discipline are also excluded.

Interruptions caused by organizational and technical reasons include those that result because of inadequate servicing of the work area and stoppages in the normal operation of equipment (waiting, for instance, for work charts and instructions, absence of means of conveyance, and interruptions in the supply of electric power, steam or water).

As a result of these analyses, measures are worked out for eliminating reasons for such interruptions.

The interruptions related to servicing of individual assemblies include periods of imposed idleness for the worker while he is performing various technological operations (heating, cooling, soaking, drawing off or conveying the product). Because of the shortness of these operations it is impossible to do other work in the meantime.

An analysis of allowable work time that provides measures for eliminating time losses and improving the existing work scheduling, makes it possible to establish standard plant norms.

Standard plant norms include only time expended in necessary operations and interruptions for rest periods and personal needs (See Chart VI). Standard plant norms for apparatus processes also include unavoidable interruption periods related to the servicing of equipment or to specific technological processes (Chart VII).

Extra work time and extra interruptions are not included in the standard hours.

Chart VI

Normal composition of operator's work time in manual and apparatus-and-manual processes

| <u>Time standard</u>                          |                           |  |
|---|---------------------------|--|
| <u>Time required for work</u>                 |                           | <u>Time required for rest and personal needs</u> |
| <u>Time for preparatory and clean-up work</u> | <u>Time for main work</u> | <u>Time for auxiliary work</u>                   |
|   |                           |  |
|   |                           |  |

Chart VII

Normal composition of operator's work time in apparatus processes

| <u>Time standard</u>                      |                       |                            |   |   |
|---|-----------------------|----------------------------|---|---|
| <u>Required time for work</u>             |                       |                            | <u>Required interruptions</u>           |   |
| <u>Preparatory and clean-up work time</u> | <u>Main work time</u> | <u>Auxiliary work time</u> | <u>Time for rest and personal needs</u> | <u>Interruptions relating to servicing of equipment</u> |
|   |                       |                            |   |   |
|   |                       |                            |   |   |

## Analysis of Equipment Operation Periods

The time involved in the utilization of equipment (apparatus) is subdivided into technological periods and periods of interruptions and down-time (Chart VIII).

Technological periods (when the apparatus is in operation) subdivide into productive and non-productive periods and loading and unloading periods.

The productive periods occur when all the processes and reactions are going on within the apparatus. The non-productive period is that time expended on overheating (against regulations), cooling and mixing of reagents, and also extra time expended because of incomplete utilization of the apparatus (incomplete filling of the apparatus, insufficient concentration of substances, and insufficient yield of finished product).

Losses of technological time may result because of the operator's knowledge of established regulations and instructions or because of inattentiveness to his work caused by the absence of necessary instruments for recording apparatus operating time (poor organization in time registration, absence of clocks in the production premises), and because of direct violations of regulations, etc.)

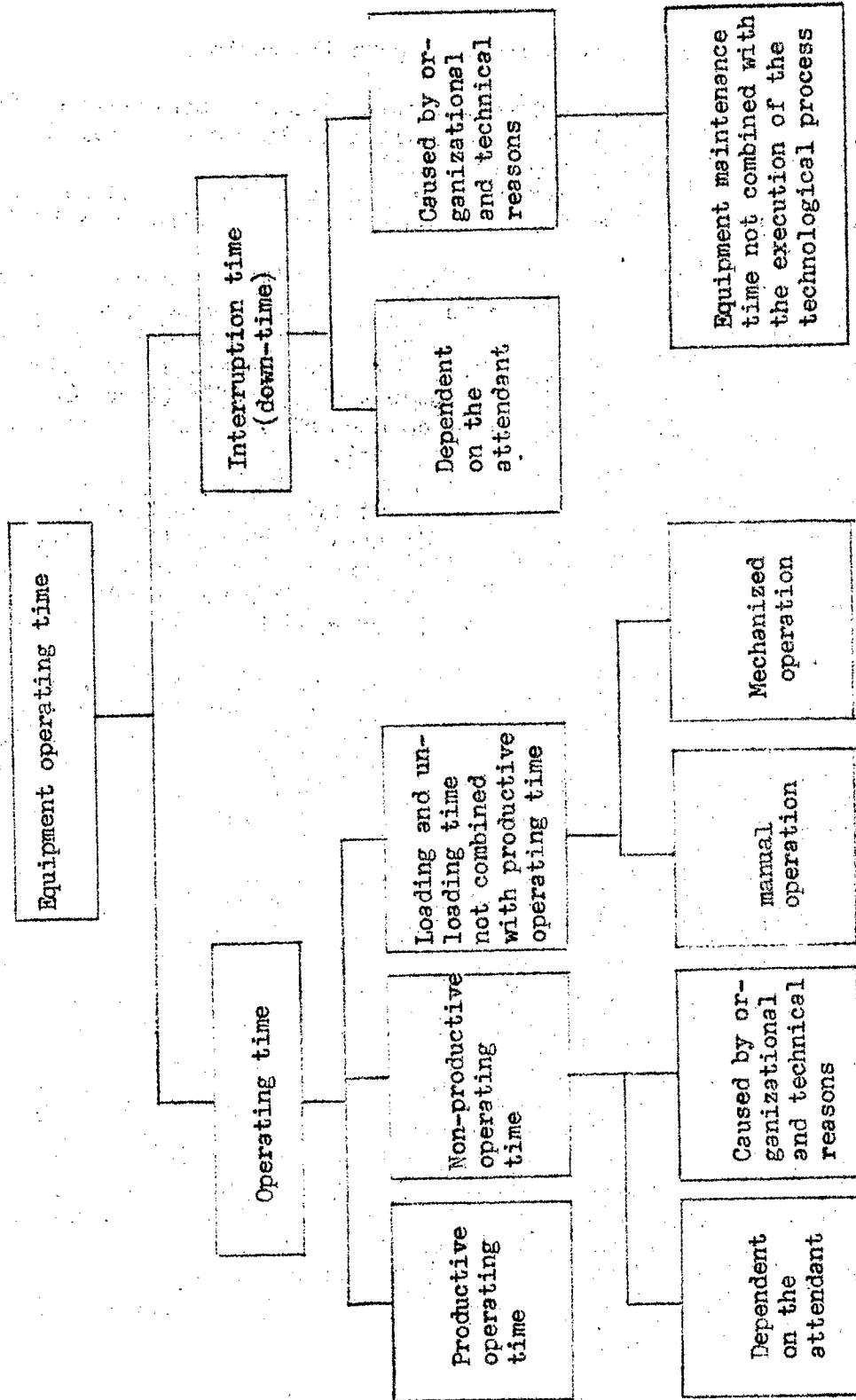
When analyzing equipment operation periods, it is necessary to determine reasons for its non-productive operations and take measures for their elimination. The study of raw material loading operations into the apparatus and the unloading of finished products and waste must be directed toward a further mechanization of these operations and toward improving their organization and decreasing their length.

Apparatus down-times are subdivided into those resulting because of the operator's actions and those resulting because of organizational and technical reasons. In the latter case, down-time results due to the unsatisfactory technical condition of equipment, inadequate preventive maintenance and repair of apparatus, and interruptions in the supply of raw materials, steam, electric power and so forth (Chart IX).

Interruptions in equipment operations resulting because of maintenance functions not in line with the technological processes (interruptions because of cleaning of equipment, changes of working parts, for example, filtering panels in the drum-type filters, are examined separately. Usually such functions are performed by production workers and are considered in the calculations of output rates. However, such operations are not always repeated in each process-turnover and are of varying periodicity. This must be determined during the study and taken into consideration when setting output rates.

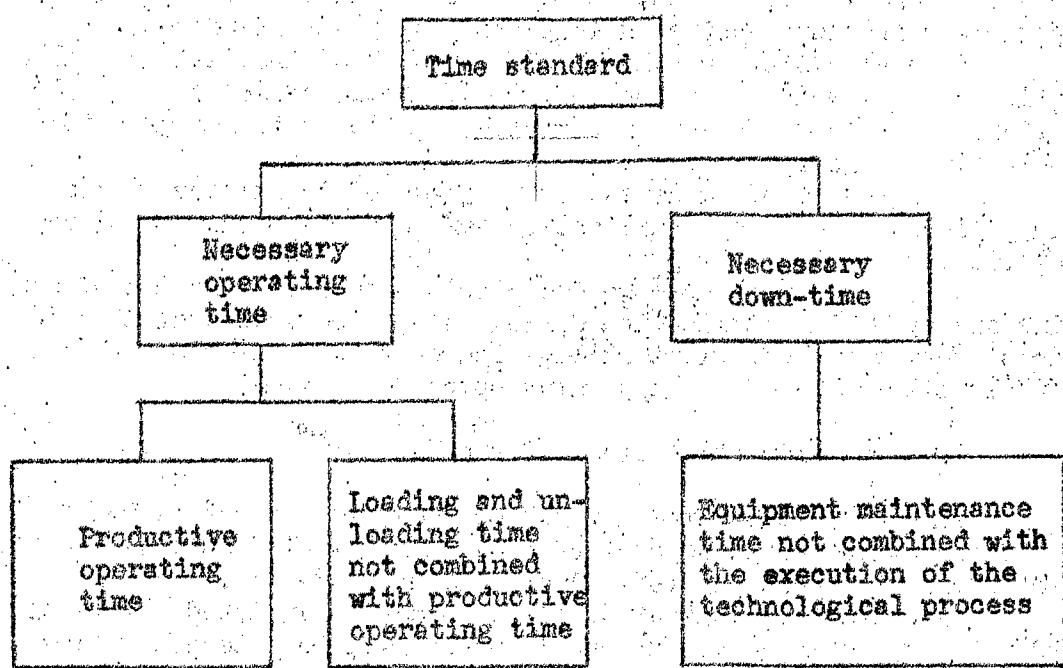
PROCESS CHART VIII

Analytical classification of equipment operating time.



PROCESS CHART IX

Normal composition of equipment operating time



While analyzing time standards, measures should be considered for decreasing the length of operations that cause apparatus down-time, for improving preventive maintenance organization and interaction of equipment in order to increase their utilization. Other down-time and interruptions, and also non-productive technological operations are not considered in setting up plant standards.

An analysis of this kind exposes cases of inefficient utilization of equipment operating periods, establishes losses, reveals deficiencies in production organization and leads to measures for their elimination.

As a result of analyses work periods of the attendant and the periods of equipment utilization are subject to survey and regulation.

Survey records show the operator's actual utilization of work time and apparatus utilization during the period analyzed. Regulations provide for efficient utilization of the operator's time and normal utilization of the apparatus operation period.

##### 5. Time and Motion Study of the Work Day

Time and Motion Study of the work day is understood to be the observation and subsequent recording of all allowable work time during the work day (shift) or some part thereof.

As previously indicated, the work day is analyzed mainly in order to expose losses of allowable work time, to determine reasons for their cause and to work out measures for their prevention. This is done from the point of view of creating conditions for increased labor productivity.

Analysis of the work day at enterprises must be done systematically.

Workers in socialist enterprises are interested in the liquidation of troubles which disturb highly productive work. For this reason they cooperate actively in the time and motion study of the work day, knowing that this contributes to reductions in losses of work time. Time and motion study includes the recording, in special records, of all that is observed at the work area, with notes on the time spent on each operation. An analysis of work-time utilization makes it possible to determine reasons for losses of such time and to work out measures for their liquidation, as well as to increase the time available for the main functions.

As an example, the study of the work day of operators removing hose from metallic mandrels is shown below. The study was made during the first shift, from 0800 to 1600 hours, with the lunch period excluded, the study continued for seven hours (420 minutes).

In order to simplify entries in the time-study record when attributing separate work-time expenditures to established cycles of operation, which are in accordance with an analytic table of work time, symbols (indices) are used. Enterprises in the chemical

industry have accepted the following symbols for individual allowable work time:

| Allowable work time                           | Index | Allowable work time  | Index |
|---|-------|--|-------|
| Preparatory and clean-up operation            | Rpz   | Incidental operations caused by organizational and technical reasons | Rsorg |
| Main  | Ro    | Rest periods and personal needs                                      | Ot    |
| Auxiliary operation                           | Rv    | Interruptions dependent on the worker                                | Pzr   |
| Incidental operations dependent on the worker | Rszer | Interruptions due to organizational and technical reasons            | Porg  |

An analysis of entries shows that during the work day production troubles arose which influenced the output. Thus, at the beginning of the shift, hoses were not delivered to the work area, which compelled worker Voronina to go after the hose at 0805 hours and to spend three minutes on that. During the shift she spent 13 minutes in going for the hoses three times. The hose remover (Voroniina) was also inadequately supplied with coils, and twice (at 0852 hours and 1200 hours) she had to prepare the coils herself and lost 19 minutes of work time. Moreover, because the auxiliary workers were engaged in other functions, Voronina had to carry the mandrels away herself and wasted six minutes in so doing.

There were down-time periods during the shift -- because of failure in supply of compressed air at 0920 hours, lasting eight minutes, and because of machine repairs, lasting five minutes.

Thus, during the day of the study it appear that the remover of the hose spent 339 minutes on her main function during the shift -- the removal of hoses; 16 minutes on preparatory and clean-up operations; six minutes for rest and personal needs, and 59 minutes of her work time were spent unproductively.

|   | Number of instances | Time spent,<br>in minutes |
|---|---------------------|---------------------------|
| Deliveries of hoses   | 3                   | 313                       |
| Carrying away mandrels  | 1                   | 6                         |
| Making coils  | 2                   | 19                        |
| Down-time   | 2                   | 13                        |
| Assistance rendered to<br>another worker in<br>unloading the vul-<br>canizing machine | 1                   | 6                         |
| Conversations with other<br>workers   | 1                   | 2                         |

With proper work scheduling, the delivery and carting of hoses and the supplying of coils is delegated to auxiliary workers who are required to make uninterrupted deliveries of supplies to the work area, and at the same time to haul away finished products. Hence, the time spent by the remover of the hoses in delivering and hauling away the hoses and making coils, is to be considered incidental, and the shop superintendent must provide for the normal furnishing of the work area with supplies and intermediate products. Actually, the time spent by the removers of hoses on the operations listed above, 38 minutes, should be used in their main operation (removing of hoses).

Time spent in repairing the machine and down-time because of failure in supplying of compressed air are not included in the calculations of time standards, since these down-times should not occur with proper maintenance of the work areas.

Time spent in rendering assistance to another worker in unloading the vulcanizing machine is also excluded from the calculation -- this function is not among the hose-remover's duties. Unproductive time spent in conversations of a personal nature should also be ignored.

An analysis of the time study of the hose-remover's operations showed that with some improvement in the servicing of the work area it was possible to increase the time spent by the hose-remover on her main operation by 13% (385 minutes instead of 339 minutes), which would lead to a corresponding increase in labor productivity and output.

Under these circumstances the hose-remover's work time during the shift will be distributed as follows (in minutes):

TIME STUDY SHEET NO.

## INDIVIDUAL TIME AND MOTION OF THE WORK DAY

Plant \_\_\_\_\_ shop \_\_\_\_\_

Department \_\_\_\_\_

Attendant

Name: Veronina

Specialization: Hose remover

Category of worker and function: V

Length of service: Total 5 years  
} In this category 3 years

| Job | Equipment |
|-----|-----------|
|-----|-----------|

Cycle: Removal of vulcanized hose Name: Fastening machine  
from metallic mandrels.

Brief description: Hose and mandrels are set into the machine and fastened; edges are trimmed; as compressed air is released hose are removed from mandrels.

Type: plant of manufacture:  
"Metallist" plant

Productivity, capacity,  
etc.

Characteristic condition:  
Machine in good condition.

Working conditions (organization of the work area, temperature, lighting, etc.): The work is done while standing; work area is uncluttered; the release of compressed air under high pressure causes noise; work is difficult.

### Tools, measuring devices:

| Name | Qty. | Characteristics |
|------|------|-----------------|
|------|------|-----------------|

Knife 1 . . . . .

### Indices of quality and quantity

Product quality during time study: No spoilage

Quality of raw material and supplies: Satisfactory

Output during time study: 410

Present output rate: 375

Time of time study:

Begun: 8:00 hours

Ended: 16:00 hours

Length: 7 hours

Observer: Mikhailova, I. D.

| Observation No. | Object of time study (description of time expenditure) | Period hr-min. | Length mins | How time spent (index) | Output in pcs |
|-----------------|--|----------------|-------------|------------------------|---------------|
| 1               | Trial release of compressor                            | 8:02           | 2           | Opc                    | 25            |
| 2               | Brings hose  | 8:05           | 3           | Oiorg                  |               |
| 3               | Removes hose   | 8:15           | 10          | Om                     | 15            |
| 4               | Brings hose  | 8:17           | 2           | Oiorg                  |               |
| 5               | Removes hose   | 8:20           | 3           | Om                     | 4             |
| 6               | Converses with neighboring worker                      | 8:22           | 2           | Int                    |               |
| 7               | Removes hose   | 8:25           | 3           | Om                     | 4             |
| 8               | Helps in loading vulcanizing vessel                    | 8:31           | 6           | Oidw                   |               |
| 9               | Removes hose   | 8:36           | 5           | Om                     | 6             |
| 10              | Rests  | 8:39           | 3           | Int                    |               |
| 11              | Makes coils for hose                                   | 8:52           | 13          | Oiorg                  |               |
| 12              | Removes hose   | 9:12           | 20          | Om                     | 25            |
| 13              | Down-time (stoppage of compressed air)                 | 9:20           | 8           | Iorg                   |               |
| 14              | Removes hose   | 9:45           | 25          | Om                     | 30            |
| 15              | Oils machine   | 9:47           | 2           | Opc                    |               |
| 16              | Removes hose   | 10:02          | 15          | Om                     | 20            |

|       |                        |       |     |       |     |
|-------|------------------------|-------|-----|-------|-----|
| 17    | Converses with Foreman | 10:04 | 2   | Opc   |     |
| 18    | Removes hose           | 10:20 | 16  | Om    | 20  |
| 19    | Removes hose           | 10:35 | 15  | Om    | 15  |
| 20    | Carries away mandrels  | 10:41 | 6   | Oiorg |     |
| 21    | Removes hose           | 11:05 | 24  | Om    | 30  |
| 22    | Removes hose           | 11:54 | 49  | Om    | 60  |
| 23    | Makes coils            | 12:00 | 6   | Oiorg |     |
| 24    | Removes hose           | 12:27 | 27  | Om    | 35  |
| 25    | Servicing of machine   | 12:32 | 5   | Iorg  |     |
| 26    | Removes hose           | 13:00 | 28  | Om    | 35  |
| 27    | Lunch                  |       |     |       |     |
| 28    | Removes hose           | 14:35 | 35  | Om    | 40  |
| 29    | Went to drink water    | 14:38 | 3   | Int   |     |
| 30    | Removes hose           | 15:02 | 24  | Om    | 30  |
| 31    | Brings hose            | 15:10 | 8   | Oiorg |     |
| 32    | Removes hose           | 15:50 | 40  | Om    | 41  |
| 33    | Delivers the products  | 16:00 | 10  | Opc   |     |
| Total |                        |       | 420 |       | 410 |

Preparation of the work area (trial start of the compressor, machine lubrication, receiving orders from the foreman) ..... 5

Removing hoses ..... 385

Turning in finished products ..... 10

Rest periods and personal needs ..... 20

#### 6. Self-Analysis (Mental Time Study) of the Work Day

The discovery of potential reserves of labor productivity comes about at enterprises with the broad participation of the workers. In part, the workers themselves register work time lost, through self-analysis and submit suggestions for eliminating the reasons that cause these losses.

Thus, self-analysis is a recording by the workers themselves of their own periods of idleness during the shift. Self-analysis is simultaneously performed by a large number of workers. The self-analysis records serve to reveal and compare losses of work time. An analysis of these losses helps to find ways for their liquidation.

Before carrying out self-analysis, the rate setter of the shop, together with the trade-union representative, has a talk with the workers when he tells them of the goal of self-analysis and techniques for carrying it out. Forms and pencils are issued to all workers who will carry out self-analysis. Workers should be able to see a wall clock from their work areas.

As a rule, self-analysis is carried out simultaneously by all workers of a particular production sector and by all shifts during the day as indicated in a schedule approved by the plant director.

A supervisor (engineer, rate setter) is appointed for this work in every shop, who is freed for the time from his other duties. The heading of the form (which indicates the worker's name, section, occupation, category, length of service) is filled in beforehand. Workers enter all losses of work time on the form, regardless of their length, indicating the reasons for their occurrence, and also deviations from normal working conditions not related to down-times but resulting in a lowering of output. Entries concerning the time of break-down or deviations from normal working conditions are made at the moment of occurrence, and entries to record their end are made at the time of their elimination.

At the end of the shift, the workers check their entries on the self-analysis forms, write in their suggestions and submit the forms to the foreman (responsible for carrying out this work). The foreman reviews the materials he receives and passes them on to the shop superintendent.

The self-analysis materials are examined by the shop superintendent together with the trade-union shop committee. They map out measures for preventing losses of work time, set time limits and appoint persons responsible for the execution of these measures and these actions are publicised by a shop-wide order.

Results of self-analysis are examined at production meetings for the information to all workers. Summaries of self-analysis results for the enterprise are reviewed at a technical conference, conducted by management with trade-union representatives, participating.

The conference results and the plan for carrying out measures for eliminating reasons causing work time losses are brought to the attention of the collective body of workers by a decree publicized throughout the plant.

#### Example of self-analysis of the working day

As an example, self-analysis records of the working day of E. G. Petrova are adduced. Self-analysis revealed easily preventable idle periods during the shift with a length of up to 35 minutes. It was also established that 18 minutes was spent (extra time) in repairing faulty mandrels.

E. G. Petrova submitted three suggestions for improving the servicing of the work area.

As entries in the chart show, the shop superintendent accepted worker Petrova's suggestion concerning the assignment of a maintenance man to the group of machines and also offered to set up a conveyor for the delivery of mandrels to the work area. Instructions regarding this were issued throughout the shop.

#### Self-Analysis Chart of the Working Day.

Dear Comrade .....

The Management and social organizations of the plant address themselves to you with a request to participate in the calculation of work time losses. With this idea in mind we please record on this self-analysis chart, interruptions (idle time) during your work, the reasons for these interruptions (idle time), and also your suggestions.

Name:

Shop: Hose

Section: Machine group

Shift: A

Time Card No: 1308

Occupation: Team leader in the gluing of pressure hoses

Length of service in this occupation: 11 years.

| Reasons for down time                                   | Work start of down time hour mins. | Time end of down time hour mins. | Losses in minutes | Deviations from normal conditions what were the deviations                      | at hour- mins. started at hour- mins. ended length in hours minutes | length in hours minutes |
|---|------------------------------------|----------------------------------|-------------------|---|---|-------------------------|
| Repair of electric motor, brush replacement             | 8:25                               | 8:36                             | 11                | Several mandrels were crooked and for this reason                               | 9:20  | 9:38 18                 |
| Delay in delivery of supplies (wire spirals)            | 11:10                              | 11:18                            | 8                 | flew out of the machine. The crew had to take them away and straighten them out |   |                         |
| Replacement of rubber tube on mandrel because of damage |                                    |                                  |                   |   |   |                         |
| Delay in delivery of supplies (wire spirals)            | 15:5                               | 15:14                            | 9                 |   |   |                         |
| Total   |                                    |                                  | 34                | Total   |   | 18                      |

Suggestions for improving production scheduling.

1. Assign a maintenance man to the machine group for repair of mandrels.
2. Set up a conveyor for delivery of mandrels with tubes to the machine group.
3. Free brigade workers of the machine group from delivery of stock.

Worker's signature

Foreman's notes (shift supervisor)

1. The electrician on duty should check the operation of the motor and condition of brushes before the start of the shift.
2. The brigade leader of the brigade installing the tubes should thoroughly check the condition of these tubes.
3. Create a permanent stock of rubberized fabric pleated covers and wire spirals.

Foreman

Shop superintendent's resume.

1. The shop mechanic should intensify the preventive maintenance system. The present instance should be taken into account when determining bonuses for electricians in the subsequent month.
2. Effective immediately, assign a repair-man to the machine group.
3. Have the technical supervisor of the shop make a sketch of the conveyor and turn it over to the design department for detail drawings. The maintenance crew will install the conveyor.
4. The foreman should check the quality of tubes after they have been installed on the mandrels and take measures to prevent low-grade tubes from reaching the machine group.

Shop Superintendent

## 7. Time Study

Time study is the study (by observation and measurement) of work time spent in the performance of individual repetitive elements of an operation.

Time study is conducted primarily to establish normal time periods required for the performance of individual elements of an operation, that is, for the calculation of a technical time standard for a specific operation.

Time study is widely used in the study of advanced work methods.

Before conducting a time study, a detailed description of the operation to be studied must be written, with indications of the elements into which the operation is to be subdivided for observation and measurement of work time expenditures. A list of these elements is included in a specific section of the time study sheet. Then begin the observations and measurements themselves of work time spent in the performance of each element of the operation.

During time study, each element of the operation acquires a series of timings indicating its length, i.e., chronochart. Lack of these timings reveals variations in the time spent in performing a specific element of the operation. The measurement and pin-pointing of unusual time lengths, resulting because of direct deviations from the established routine in the performance of elements of the operation (because of spoilage, work delays, incidental troubles), are noted in the time study sheet and are excluded from the chronochart in further calculations. The reasons for variations in time amounts in the remaining timings are studied and, with the participation of the workers, measures are taken to eliminate these variations.

With such utilization of chronochart data normal time lengths are set for the performance of each element in the operation and are accepted as the base for calculations of technical time standards for each operation.

As an example, time study records are shown below for "the removal of vulcanized hoses from mandrels" (84 and 85). For convenience in the study of time allowances the work was subdivided into the following elements:

1. Take mandrel and position in machine.
2. Trim edges off hose.
3. Tighten coils on hose.
4. Roll up hose on mandrel.

5. Remove hose.

6. Cast mandrel aside.

The performance times of separate work elements, measured by means of a stop-watch, are entered on the time study sheet.

The execution of the first element of work, "Take mandrel and fix in machine," began at 1000 hours and ended at 1000 hours, 5 seconds; the second "trim edges off hose" ended at 1000 hours, 15 seconds; and the third -- 1000 hours, 22 seconds. During the work process, at 1000 hours, 22 seconds, the hose rolled up badly, and an appropriate entry was made in the lower part of the time study sheet (this entry is necessary so that when these records are analyzed, the reason for the delay in performance of this specific element of work can be noted).

The time of individual elements is determined by subtracting the figures of the preceding entry from the one following and is entered on the line marked "L" in the time study sheet. It is evident from the sheet that the first element of work "Take mandrel and fix in machine" usually took 5 seconds, sometimes 6, and just once it took 10 seconds because the mandrel fell off the machine, which was recorded in the lower part of the time-study sheet. When analysing the time expended in performing the first element of the operation this figure is not taken into consideration. One such figure appears in the first line, one in the third line, and two in the fourth. After totalling the measured time, with the exception of the unusually large ones, the average performance time is calculated. In our example, the average time of the first element is 5.3 seconds, the second -- 10.6 seconds, etc.

Subsequently, an analysis is made and the work methods of an average worker are compared with the methods used by production workers.

An analysis and comparison of data in the example shown makes it possible to come to the following conclusions:

1. The first element, "Take mandrel and position it in machine," was almost always completed with the same speed during these observations. Its average performance time, 5.3 seconds, may be accepted as the normal time.

2. The performance time of the second element "Trim edges off hose" has considerable variation. Increases in allowable time during the second, fifteenth and sixteenth timings are not justifiable, and these timings are not included in the calculations. The new average time of 10.3 seconds is accepted as normal time.

## Plant

## TIME STUDY SHEET

Shop

## Attendant

Name: Stepanova  
Specialization: Hose remover  
Length of service: 15 years  
in this job: 5 years

Job specification: Removal of vulcanized hose from steel hose mandrels.

Brief description: Hose and mandrels are set into machine and fastened; edges are trimmed; as compressed air is released a hose are removed from mandrels.

Observer: Mikhailova. Time of observation (Begin: 10:00 hours Ended: 11:00 hours)

| Element number | Elements of operation           | Timings                       |                               |                               |                               |                               |                               |                               |                               |                               |                               |                               |
|----------------|---------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
|                |                                 | 1                             | 2                             | 3                             | 4                             | 5                             | 6                             | 7                             | 8                             | 9                             | 10                            | 11                            |
| 1              | Take mandrel and fix in machine | 5 <sup>1</sup> / <sub>2</sub> | 1 <sup>1</sup> / <sub>2</sub> | 2 <sup>1</sup> / <sub>2</sub> | 2 <sup>1</sup> / <sub>2</sub> | 2 <sup>1</sup> / <sub>2</sub> | 3 <sup>1</sup> / <sub>2</sub> | 4 <sup>1</sup> / <sub>2</sub> | 4 <sup>1</sup> / <sub>2</sub> | 5 <sup>1</sup> / <sub>2</sub> | 6 <sup>1</sup> / <sub>2</sub> | 6 <sup>1</sup> / <sub>2</sub> |
| 2              | Trim edges off hose             | 15                            | 106                           | 144                           | 224                           | 306                           | 345                           | 426                           | 501                           | 516                           | 627                           | 710                           |
| 3              | Fasten coils on hose            | 22                            | 113                           | 151                           | 233                           | 314                           | 353                           | 435                           | 517                           | 554                           | 636                           | 719                           |
| 4              | Roll up hose on mandrel         | 34                            | 119                           | 159                           | 241                           | 319                           | 401                           | 440                           | 522                           | 602                           | 644                           | 721                           |
| 5              | Remove hose                     | 38                            | 123                           | 202                           | 244                           | 323                           | 405                           | 443                           | 526                           | 605                           | 648                           | 728                           |
| 6              | Cast mandrel aside              | 44                            | 129                           | 209                           | 249                           | 328                           | 410                           | 448                           | 531                           | 622                           | 654                           | 733                           |

| Elements of operation             | Timings |      |      |       |       |       |       |       |       |    | A   | B    | C |
|-----------------------------------|---------|------|------|-------|-------|-------|-------|-------|-------|----|-----|------|---|
|                                   | 12      | 13   | 14   | 15    | 16    | 17    | 18    | 19    | 20    |    |     |      |   |
| 1 Take mandrel and fix in machine | 7.38    | 8.27 | 9.07 | 9.48  | 10.30 | 11.12 | 11.55 | 12.39 | 13.19 | 19 | 101 | 5.3  |   |
| 2 Trim edges off hose             | 7.48    | 8.37 | 9.17 | 10.00 | 10.42 | 11.23 | 12.06 | 12.49 | 13.29 | 20 | 212 | 10.6 |   |
| 3 Fasten coils on hose            | 7.56    | 8.46 | 9.26 | 10.07 | 10.49 | 11.32 | 12.15 | 12.57 | 13.37 | 19 | 155 | 8.2  |   |
| 4 Roll up hose on mandrel         | 8.11    | 8.54 | 9.31 | 10.14 | 10.57 | 11.41 | 12.23 | 13.05 | 14.00 | 18 | 129 | 7.2  |   |
| 5 Remove hose                     | 8.15    | 8.57 | 9.38 | 10.17 | 11.00 | 11.44 | 12.27 | 13.08 | 13.48 | 20 | 71  | 3.6  |   |
| 6 Cast mandrel aside              | 8.21    | 9.02 | 9.33 | 10.24 | 11.06 | 11.50 | 12.34 | 13.14 | 13.54 | 20 | 116 | 5.8  |   |

Seconds required

| Deviations from normal conditions |                     |    |                     |   |  |  |  |  |  |
|-----------------------------------|---------------------|----|---------------------|---|--|--|--|--|--|
| Indices                           | Period from         | to | Length in sec.      | Reasons for defective timings and interruptions |  |  |  |  |  |
| 1/1                               | 10 hrs 22 sec       |    | 10 hrs 34 sec       | 12 Hose rolled up badly                         |  |  |  |  |  |
| 1/2                               | 10 hrs 44 sec       |    | 10 hrs 54 sec       | 10 Mandrel fell off machine                     |  |  |  |  |  |
| 3/8                               | 10 hrs 5 min 04 sec |    | 10 hrs 5 min 17 sec | 13 Spiral broke off                             |  |  |  |  |  |
| 1/12                              | 10 hrs 7 min 56 sec |    | 10 hrs 8 min 11 sec | 15 Hose rolled up badly                         |  |  |  |  |  |

\*T = stop-watch timings, L = Length of element, A = Number of calculable timings, B = Total length of calculable timings, C = Average length of calculable timings.

3. Peredovik production workers operate with higher machine speeds, which is possible for all workers to do. Hence, the allowable time of the fourth element "Roll up hose on mandrel" may be decreased to 6.0 seconds and the fifth element "Remove hose" to 3.0 seconds.

After determining the allowable time of individual elements of the operation, the time necessary for the output of one unit of production is calculated (see Table 3).

After establishing allowable time of main operations during the shift based on analyses of self-analysis records and time study sheets --- showing the allowable time rate in the output of one unit of production, it is then possible to calculate output rates:

$$N_{out} = \frac{385}{0.64} = 600 \text{ pieces (rounded off)}$$

where 385 = work time during the shift spent for removal of hoses (see page 77)

0.64 = time in processing one mandrel (table 3)

Table 3

Calculation of time needed in the output of one unit of production (according to time study data)

| Opera-<br>tion<br>element<br>element<br>No. | Name of<br>element<br>(of the<br>operation) | Actual<br>average<br>time, sec. | Factors<br>influenc-<br>ing its<br>lengths                                  | Normal<br>time, sec-<br>trative<br>sec. | Admini-<br>strative<br>and tech-<br>nical<br>measures | date<br>mea-<br>sures<br>taken |
|---|---|---------------------------------|---|---|---|--------------------------------|
| 1   | Take mandrel<br>and fix in<br>machine       | 5.3                             | distance<br>between<br>storage<br>place for<br>mandrels<br>and work<br>area | 5.3                                     |   |                                |
| 2   | Trim edges<br>off hose                      | 10.6                            | Degree<br>of knife<br>sharpness   | 10.3                                    |   |                                |

|    |                                 |      |                                  |                     |  |
|----|---------------------------------|------|----------------------------------|---------------------|--|
| 3  | Tighten coils on hose           | 8.2  | Quality of coils                 | 8.2                 |  |
| 4  | Roll up hose on mandrel         | 7.2  | Machine speed                    | 6.0                 | Increase speed of machine up to speeds achieved by front-rank production workers 15/12 |
| 5. | Hose removal                    | 3.6  | Machine speed                    | 3.0                 |  |
| 6. | Cast mandrel aside              | 5.8  | Distance to mandrel storage area | 5.8                 |  |
|    | Total on one unit of production | 40.7 |                                  | 38.6<br>(0.64 min.) |  |

### 8. Calculations of Output Rates in Intermittent processes

Output rates for machine operators, servicing apparatus with intermittent operations, are calculated according to the formula:

$$N_{out.} = \frac{L - L_1}{L_2} \cdot 0$$

(1)

where  $N_{out.}$  = output rate for shift (in kilograms, meters, liters pieces, etc.);

$T$  = duration of shift, in minutes;

$T_1$  = time of shut-downs and idle time during shift in the execution of operations (when taking over and surrendering shift, maintenance of equipment, etc.) in minutes;

$T_{ts}$  = length of operation, based on records studied, in minutes;

$V$  = output quantity produced in one operation.

In those cases where  $T_1$  (shut-downs and idle time in the operation of apparatus related to the servicing of equipment) is repeated after a certain number of operations, the output rate is calculated according to the formula:

$$N_{out.} = \frac{T}{T_2 + \frac{T_1}{N}} \cdot V \quad (2)$$

where  $T_1$  = length of regularly repetitive stoppages or interruptions in the execution of the operation;

$N$  = number of operations, in which shutdowns and idle time are repeated.

If the apparatus functions during the shift without shut-downs (related to their servicing) the output rate is calculated according to the formula:

$$N_{out.} = \frac{T}{T_2} \cdot V \quad (3)$$

Example of the calculation of an output rate for centrifuges.

A practical application of formula (1) may be demonstrated in example showing the setting of an output rate for an operator working at the centrifuge.

The centrifuge operation consists of several independent elements.

An analysis of the study records of the centrifugation operation and of methods used on the servicing of the centrifuge by peredovik production worker made it possible to establish time standards (Table 4).

Output of products in one operation is 240 kg; twelve minutes were spent in washing out the centrifuge during the shift. Thus, the output rate at the centrifuge for the eight-hour shift (during a seven-hour work day), according to formula (1) is:

$$N_{out.} = \frac{480 - 12}{36} \cdot 240 = 3120 \text{ kg}$$

Table 4  
Time Standards in Centrifugation

| Operation element<br>No. | Description of element         | Time standard<br>minutes |
|--------------------------|--------------------------------|--------------------------|
| 1                        | Loading and closing cover      | 9.0                      |
| 2                        | Squeezing out mother liquor    | 11.0                     |
| 3                        | Braking the centrifuge         | 0.5                      |
| 4                        | Pouring in of washing water    | 1.0                      |
| 5                        | Squeezing out washing water    | 6.5                      |
| 6                        | Braking the centrifuge         | 0.5                      |
| 7                        | Removal of cover and unloading | 7.5                      |
| Total                    |                                | 36.0                     |

Example showing the Calculation of an Output Rate on  
Filter Presses.

As an example, the calculation of an output rate at filter  
presses according to formula (2) is shown below.

Table 5  
Time Standard for Filtration Process

| Operation<br>Element<br>No. | Description of element  | Time standard<br>minutes     |
|-----------------------------|---|------------------------------|
| 1                           | Unloading and assembly of filter press .. including:<br><br>Dismantling of frames .. ....<br>Unloading and draining residue .. ....<br>Assembly of frames .. ....                                       | 20<br>5<br>12<br>3           |
| 2                           | Filtration .. ....  | 50                           |
| 3                           | Cleaning of filter press frames .. ....   | 20                           |
| 4                           | Replacement of filter panels .. ....<br><br>including:<br><br>Removal of used filter panels .. ....<br>Carting away filter panels .. ....<br>Delivery of filter panels .. ....<br>Tightening up .. .... | 30<br>12<br>2.5<br>2.5<br>13 |

The filter press frames are cleaned once every four operations, and filter panels are changed once every six operations.

When the output rate during the operation is 15 kg the rate of output at the filter press is calculated according to formula (2).

$$N_{\text{out.}} = \frac{480}{(20 + 50) + \frac{20}{4} + \frac{30}{6}} 15 = 90 \text{ kg}$$

Example Showing the Calculation of an Output Rate for an Operator working at rubber footwear vulcanizing Machine (autoclave)

Vulcanization of rubber footwear in a horizontal vulcanizing machine consists of a series of operations (Table 6).

Table 6

Vulcanizing Process Time Standards

| Description of operations                                       | Time standards<br>minutes |
|---|---------------------------|
| Loading machine, closing and fastening cover of machines        | 9.0                       |
| Vulcanization of rubber footwear                                | 105.0                     |
| Lifting machine cover and unloading wagons with rubber footwear | 6.0                       |
| Total   | 120.0                     |

Eight large wagons of rubber footwear (300 pairs in each) and one small wagon with a capacity of 126 pairs are loaded into the autoclave.

Using the established time standard and quantity of finished products as the base, the output rate is calculated according to formula (3):

$$N_{out.} = \frac{480}{120} (8 \times 300 + 126) = 10,104 \text{ pairs of rubber footwear}$$

Example Showing the Calculation of an Output Rate in the Production of Captax

A production process usually consists of a number of successive stages which are completed by equipment of varying productivity.

For establishing output rates for such a process it is necessary to begin with the productivity of the main apparatus (the main operation) if the other stages reprocess products extracted from the apparatus performing the main operation.

As an example, the method for calculating the output rate in the production of Captax is shown below: ([Note] Captax -- a yellow powder, used as a vulcanization accelerator in the manufacture of rubber products, and also in the production of plastics and lacquers.)

The production process for the extraction of Captax consists of the following operations:

1. Condensation in autoclaves;
2. Dissolution of Captax in alkali (in vats);
3. Filtrating of Captax alkali solution in filtering apparatus purifying it of resins in the columns;
4. Isolation of Captax in vessels;
5. Filtering and washing of Captax in centrifuges.

The basic factors in the process were determined as a result of a preliminary study (Table 7).

Table 7

Basic Factors in the Process of Captax Production

| Factors   | Production sectors |                  |                 |                |                 |
|---|--------------------|------------------|-----------------|----------------|-----------------|
|   | conden-<br>sation  | disso-<br>lution | filtra-<br>tion | isola-<br>tion | filtra-<br>tion |
| Number of apparatus                                     | 2                  | 2                | 2               | 2              | 4               |
| Apparatus capacities, ltr.                              | 1,000              | 4,000            | 6 cm            | 4,000          | -               |
| Length of operations (according to regulations) hr-min. | 6-00               | 5-00             | 5-30            | 5-00           | 3-00            |
| Product output of each operation, kg                    | 750                | 750              | 750             | 750            | 750             |
| Work shift hr-min.                                      | 6-00               | 6-00             | 6-00            | 6-00           | 6-00            |

|                                 |   |   |   |   |    |
|---------------------------------|---|---|---|---|----|
| Number of workers in shift      | 1 | 1 | - | 1 | 2  |
| Number of workers in all shifts | 5 | 5 | - | 5 | 10 |

Production outputs at individual sectors of production (according to operation) were not considered; the product was weighed in the last stage after filtration and the output of each operation was considered to be equal to the end yield. In calculating equipment productivity and output rates the product yield was set at 750 kg for each operation.

The above data were processed, systematized and subjected to analysis.

The analysis of time spent (taking into account the work experience of peredovik production worker) showed that standards presently established by regulations were obsolete and should be revised, and the time of each individual operations may be reduced. As a result of the analysis, new standards were set for the time required for the condensing and autoclaving operations (Table 8).

Table 8

Establishing Time Standards for the Condensing Operation

| Description of operations        | Actual time expended hour-min. | Allowable time standards, hour-min. |
|----------------------------------|--------------------------------|-------------------------------------|
| Loading of apparatus             | 0-21                           | 0-20                                |
| Heating                          | 1-38                           | 1-30                                |
| Soaking                          | 1-30                           | 1-30                                |
| Lowering of pressure             | 0-18                           | 0-15                                |
| Squeezing                        | 0-24                           | 0-20                                |
| Cooling the autoclave and drying | 0-49                           | 0-45                                |
| Total                            | 5-00                           | 4-40                                |

The shift output of the autoclave section is calculated on the basis of established time standards and the accepted production output of one operation:

$$\frac{6 \text{ hours}}{4 \text{ hours } 40 \text{ minutes}} \times 2 \times 750 = 1,927.5 \text{ kg}$$

The calculations assume the following data: length of work shift -- 6 hours; number of apparatus -- 2; product output in one operation -- 750 kg; time standard -- 4 hours, 40 minutes.

The analysis showed that it was possible to shorten the time of the dissolution operation and to set new time standards (Table 9).

Table 9

Establishing Time Standards for the Dissolution Operation

| Description of operations          | Actual time spent<br>hour-min. | Time standards<br>hour-min. |
|------------------------------------|--------------------------------|-----------------------------|
| Check and preparation of apparatus | 0-10                           | 0-09                        |
| Receiving water and alkali         | 0-18                           | 0-16                        |
| Receiving allys                    | 0-33                           | 0-30                        |
| Soaking                            | 2-30                           | 2-30                        |
| Mixing with water                  | 0-12                           | 0-11                        |
| Analysis                           | 0-10                           | 0-10                        |
| Draining                           | 0-36                           | 0-34                        |
| Total for the operation            | 4-29                           | 4-20                        |

The shift efficiency of dissolution vats is calculated on the basis of established standards and the accepted production output:

6 hours       $2 \times 750 = 2,077 \text{ kg}$   
4 hours 20 minutes

New rates are also set for the filtering operation (Table 10)

Table 10

Establishing Time Standards for the Filtering Operation

| Description of operations  | Actual time spent | Time Standards, hour-min. |
|----------------------------|-------------------|---------------------------|
| Receiving the product      | 0-38              | 0-30                      |
| Filtration                 | 3-42              | 3-40                      |
| Cleaning filters of resins | 0-20              | 0-20                      |
| Washing filters,           | 0-12              | 0-10                      |
| Total                      | 4-52              | 4-40                      |

The shift efficiency of the two filtering apparatus is calculated on the basis of set time standards and the accepted production output:

6 hours       $2 \times 750 = 1,927.5 \text{ kg}$   
4 hours 40 minutes

The length of the operation of Captax isolation was set at 4 hours and 20 minutes. Hence, the change in efficiency of the apparatus would be:

6 hours       $2 \times 750 = 2,077 \text{ kg}$   
4 hours 20 minutes

The newly set time of one centrifugation of Captax is 2 hours, and the whole operation --- 8 hours. Thus, the change in the efficiency of the centrifuge would be:

$$\frac{6 \text{ hours}}{8 \text{ hours}} \cdot 4 \times 750 = 2,250 \text{ kg}$$

The shift output rate for all operating production shops is calculated on the basis of established apparatus efficiency in various departments during the shift.

The above calculations show the disparity in the productivity of individual assemblies. The first section, condensation in autoclaves, is a "bottleneck," as is the filtration section which can process only 1,927.5 kg of product during one shift (see figure 9).

Because of this, the output rate for all stages of production is set at 1,927.5 kg for the shift.

With this set output rate the only equipment that is fully utilized is in the condensation and filtration sections. Hence, engineer and technical workers must take measures, guided by the experiences of peredovik workers to increase overall shop efficiency.

The capacity of shop section may also be increased by further shortening the length of operations; this is quite possible if all workers learn methods used by peredovik production workers. If necessary, a third autoclave may be installed in the condensation section and a third filter press in the filtering section, carrying shop productivity to the level of the second section productivity, that is, up to 2,077 kg of product per shift.

#### 9. Calculating Output Rates in Continuous Processes

Output rates for continuously operating apparatus are calculated according to the formula:

$$N_{\text{out.}} = (T - T_1) \times V \quad (4)$$

where  $T$  = length of the period during which output rate is calculated (hour, shift, day, month);

$T_1$  = length of equipment down-time during preventive maintenance, in hours;

$V$  = production output, kg/hr.

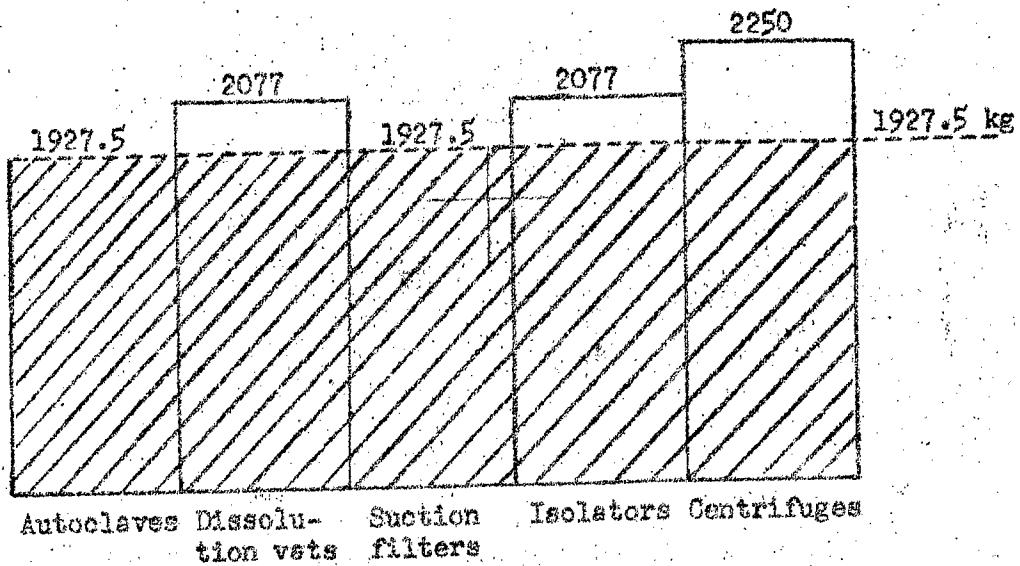


Figure 9. Productivity of individual assemblies (in kg) and their utilization.

Example Showing the Calculation of an Output Rate in  
the Sulfuric Acid by Contact Process

The burning section, which determines the productivity of the whole facility, is the main section. Hence, the output rate of the whole facility may be calculated using the productivity of the burning section, as the base.

Let us assume that one furnace produces 1,350 tons of acid an hour (when converted to monohydrate). The section has four operating furnaces of the same capacity serviced by one brigade; no preventive maintenance is contemplated for these furnaces during this particular month.

Under these conditions, the shift output rate of the facility is:

$$N_{out} = 8 \times 4 \times 1,350 = 43.2 \text{ tons of acid (in monohydrate state),}$$

where 8 = length of shift in hours;

4 = number of furnaces serviced of the same capacity

1,350 = acid yield from each furnace, kg/hr.

Method for establishing the Output Rate for Calcium Carbide.

The self-analysis of functions of four brigades must be examined in order to calculate the production rate for calcium carbide.

Industrial calcium carbide is prepared by burning lime with coke or anthracite in an electric furnace. The carbide forming in the furnace is periodically poured out through openings in the furnace bath opposite each electrode. The burned carbide flows through cast-iron troughs into cast-iron molds placed near the openings. The carbide is preliminarily cooled and hardened in the molds.

Carbide at each electrode must be poured out regularly, (phase pouring). Samples are taken during the pouring. Carbide furnaces with a capacity of 4,500 kilowatt, with the electrodes arranged in a row, had the following frequency of carbide pourings established, by phases, according to the technological chart: I and II phase -- every 35 minutes; III phase - every hour.

The displacement capacity of carbide as it is poured out of the furnace should not be less than 290 liters/kg.

([Note:] Displacement capacity of carbide -- quantity of acetylene which may be extracted by decomposing 1 kg of calcium carbide with water at 20°C and atmospheric pressure at 760 mm of mercury.)

An analysis of the operational indicators of four teams, based on the work day self-analysis data, shows that the number of pourings made during the shift were as follows: Ivanov's brigade -- 23, Sidirov's -- 24, Petrov's -- 26, and Nikulin's brigade -- 21. The average number of pourings during the shift was 23.5; carbide output -- 9,675 tons; average expenditure of electric power -- 2,938 kilowatt-hours/ton; and the average displacement capacity was 293.2 liters/kg. (Table 11).

Table 11

Basic Indicators of brigade operations in the production of carbide

| Brigade leaders | Number of phase pourings |     |     |       | Output for one shift tons | Average product yield each pouring | Displacement capacity liter/kg | Electric power consumption kw-hr/ton |
|-----------------|--------------------------|-----|-----|-------|---------------------------|------------------------------------|--------------------------------|--------------------------------------|
|                 | I                        | II  | III | Total |                           |                                    |                                |                                      |
| Ivanov          | 9                        | 10  | 4   | 23    | 9,682                     | 421                                | 291                            | 2,930                                |
| Sidorov         | 7                        | 9   | 8   | 24    | 9,556                     | 398                                | 294                            | 2,920                                |
| Petrov          | 11                       | 6   | 9   | 26    | 9,767                     | 376                                | 294                            | 2,900                                |
| Nikulin         | 8                        | 9   | 4   | 21    | 9,696                     | 462                                | 294                            | 3,000                                |
| Averages        | 8.8                      | 8.5 | 6.2 | 23.5  | 9,675                     | 412                                | 293.2                          | 2,938                                |

Petrov's brigade performs 26 pourings during the shift (with 23.5 pourings as an average for the entire shift); the shift output for the brigade is 9,767 tons of carbide, that is, it exceeds the average shop brigade output by 92 tons.

The analysis of data concerning Petrov's brigade makes it possible to determine how they achieve these successes in their work. First of all, Petrov takes over his shift conscientiously; he inquires of the foreman of the previous shift how the furnace worked, what was the condition of the electrodes, what is the composition of the raw material flow, the displacement capacity of the carbide yield, etc. Then he discusses the forthcoming work with workers of his brigade and gives them instructions concerning the execution of the process and servicing of equipment.

During the process Petrov spends a significant part of his time in servicing the top of the furnace; for all that, he not only supervises the work of the refuelers but participates directly in the operation.

The crucial burning through of taps operation is done by Petrov personally.

Having made more frequent pourings of carbide than made by other technicians, Petrov did not allow carbide to overheat in the bath; as a result, product losses because of evaporation were decreased, and so was the consumption of electric power. Petrov makes timely adjustment of the electrodes.

After a prolonged study of the calcium carbide forming process, Petrov, a production expert, came to the conclusion that the accepted frequency of carbide pourings was not enough, that it led to increased losses of carbide in its forming process and to a reduction of its quality. Petrov, with the permission of the shop superintendent, increased the number of carbide pourings and at the end of each shift, together with the shop superintendent, analyzed the results of his work. Then, based on a special technical standard study, a schedule was worked out (Table 12) which provided for a strict sequence of carbide pourings by phases (sketch 10) specifically: every half-hour -- by phases I and II, and every hour -- by phase III. Thus, 30 carbide pourings are made during a six-hour shift (12 pourings each from phases I and II and six pourings from phase III).

From the first phase the carbide is poured twice during one hour; the first pouring is begun after 10 minutes and the second 40 minutes after the beginning of each hour.

From the second phase -- as above, after 20 and 50 minutes, respectively.

From the third phase the carbide is poured only once an hour.

A schedule for more frequent loadings of furnace charges was worked out to correspond to the above -- small portions at equal time intervals.

The experience with the new schedule confirmed (Table 13) certain possibility of performing 30 carbide pourings during the shift and of improving other indicators.

Table 12

Adjusted hourly Schedule of Speed-up Carbide  
Pourings by Phases  
(hours-minutes)

| Hour of work                 | Phase I       |             | Phase II      |             | Phase III     |             |
|------------------------------|---------------|-------------|---------------|-------------|---------------|-------------|
|                              | Start of pour | End of pour | start of pour | end of pour | start of pour | end of pour |
| 1st                          | 0-10          | 0-15        | 0-20          | 0-25        | 0-30          | 0-35        |
| 2nd                          | 0-40          | 0-45        | 0-50          | 0-55        | --            | 0-35        |
| 2nd                          | 1-10          | 1-15        | 1-20          | 1-25        | 1-30          | 1-35        |
|                              | 1-40          | 1-45        | 1-50          | 1-55        | --            | --          |
| 3rd                          | 2-10          | 2-15        | 2-20          | 2-25        | 2-30          | 2-35        |
|                              | 2-40          | 2-45        | 2-50          | 2-55        | --            | --          |
| 4th                          | 3-10          | 3-15        | 3-20          | 3-25        | 3-30          | 3-35        |
|                              | 3-40          | 3-45        | 3-50          | 3-55        | --            | --          |
| 5th                          | 4-10          | 4-15        | 4-20          | 4-25        | 4-30          | 4-35        |
|                              | 4-40          | 4-45        | 4-50          | 4-55        | --            | --          |
| 6th                          | 5-10          | 5-15        | 5-20          | 5-25        | 5-30          | 5-35        |
|                              | 5-40          | 5-45        | 5-50          | 5-55        | --            | --          |
| Total<br>for 6-hour<br>shift |               | 12 pours    | 12 pours      | 6 pours     |               |             |

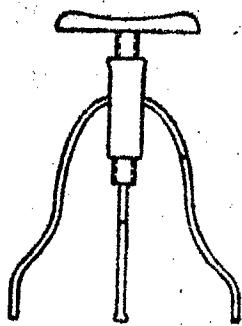


Fig. 4.

Design of the stool  
used at the "Krasnyy  
Treugol'nik" plant.

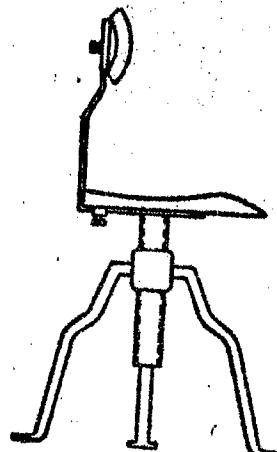


Fig. 5.

Design of the stool  
used at the "Skorokhod"  
plant.

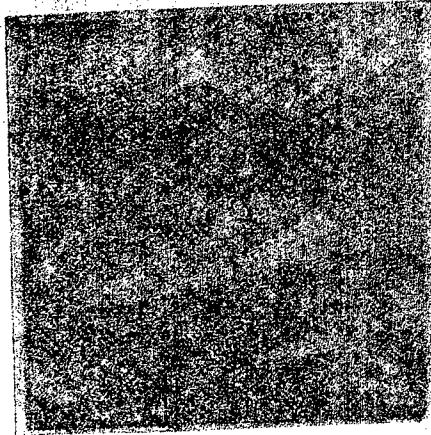


Fig. 6. Uncomfortable position of worker: body bent, elbows spread wide apart

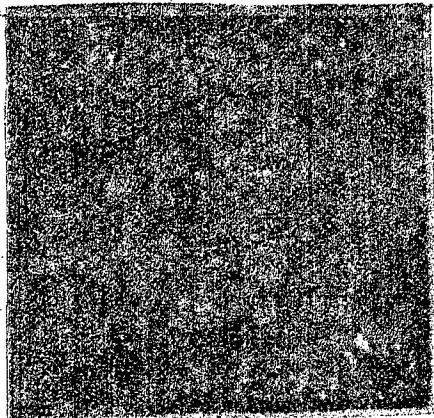


Fig. 7. Comfortable position of worker: body erect, main motions with wrists



Fig. 8. Difference in worker's position with (a) unimproved and (b) improved work bench

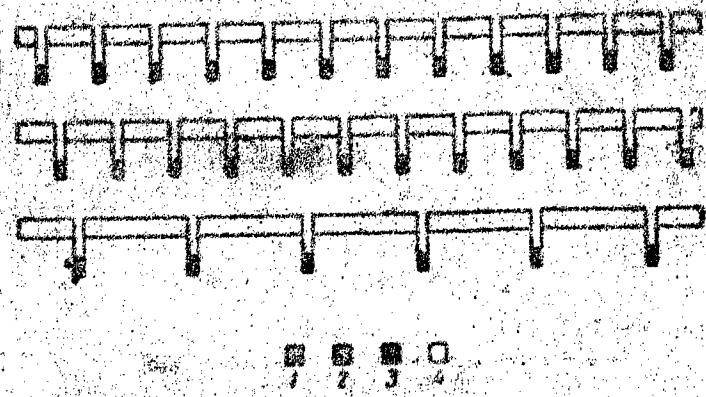


Fig. 10. Adjusted hourly schedule of speed-up carbide pourings by phases.

1. Carbide pouring from the electrode phase I;
2. the same, from phase III;
3. the same, from phase III;
4. intervals between the pouring processes.

The data in Table 13 (set up according to records of the repeated time study indicate that as a result of adopting new methods in their operations, all brigade of carbide workers significantly increased their efficiency factors. Petrov's brigade made 31 pours. Their output was 524 tons higher than the average output for all shop brigades, their rate of electric power was 30 kw-hrs/ton lower than the average, and carbide displacement capacity was 1 ltr/kg higher than the average.

Table 13

Basic Indicators Of Brigade Operations in Carbide Production  
(according to data from the repeated time  
study)

| Team leaders | Number of pours<br>by phases |    |     |       | output<br>for<br>the<br>shift,<br>tons | Average<br>product<br>yield<br>each<br>pouring | Dispalce-<br>ment<br>1t/kg | Electric<br>power ex-<br>pendi-<br>ture<br>kw/hr/ton |
|--------------|------------------------------|----|-----|-------|--|--|----------------------------|--|
|              | I                            | II | III | Total |  |  |                            |  |
| Petrov       | 12                           | 12 | 7   | 31    | 10,394                                 | 335.3  | 295                        | 2,860  |
| Sidorov      | 12                           | 12 | 6   | 30    | 9,635                                  | 321.2  | 294                        | 2,880  |
| Ivanov       | 10                           | 12 | 7   | 29    | 9,773                                  | 337.0  | 292                        | 2,890  |
| Nikulin      | 12                           | 12 | 7   | 31    | 9,680                                  | 312.2  | 294                        | 2,930  |
| Average      | 11.5                         | 12 | 6.7 | 30    | 9,870                                  | 329.0  | 294                        | 2,890  |

Subsequent to this study, the technological regime was reviewed and new output rates were calculated.

The new schedule provided for 30 pours during a shift. The average yield of carbide from one pour according to the time study data, was from 312 to 337 kilograms.

Petrov's brigade production factors were accepted as the base in establishing advanced output rates. Carbide yield rate was set at 330 kg, with power consumption set at 2,860 kw-hr/ton and carbide displacement capacity at 294 ltr/kg.

With these rates as the base, the following shift output rate was established for a six hour period:

$$30 \times 330 \text{ kg} = 9,900 \text{ tons}$$

with carbide displacement capacity at 294 ltr/kg and power consumption of 2,860 kw-hr/ton.

#### 10. Method for Calculating Conveyor Output Rates

As an example, the calculation of an output rate for the assembly of men's rubber footwear, style 110 NK, on conveyors is shown below. The conveyor is a table 30 to 45 meters long and 1.1 to 1.2 meters wide with conveyor belt 350 mm wide, running through its center. The lasts, moved by the conveyor belt, pass from one work area to another. A specific number of workers is placed on both sides of the conveyor corresponding to the order in which they perform a certain operation in the assembly of the rubber footwear. The workers on one side of the conveyor assemble rubber footwear for the right foot and those on the other side -- for the left foot.

The assembly of men's footwear, Style 110 NK, consists of 22 operations (Table 14).

Table 14

| Operation number | Description of Operation  | Length of operation | Number of workers | Average performance min. | Load of each worker min. |
|------------------|---|---------------------|-------------------|--------------------------|--------------------------|
| 1                | Take last and uppers; put uppers on last; place last on conveyor belt   | 0.106               | 1                 | 0.106                    | 97.2                     |
| 2                | Take last from conveyor; grasp colored insole; lay colored insole on last; tighten uppers on insole. Grasp roller and perform roll-up. Place last on conveyor | 0.436               | 4                 | 0.109                    | 100.0                    |
| 3                | Oil frame of footwear   | 0.216               | 2                 | 0.108                    | 99.1                     |

|    |  |       |   |       |      |
|----|--|-------|---|-------|------|
| 4. | Take last from conveyor;<br>grasp thick counter,<br>lay it on and roll up<br>with roller; place<br>last on conveyor                          | 0.210 | 2 | 0.105 | 96.3 |
| 5  | Take last from conveyor;<br>grasp calico toe, lay<br>it on and roll up with<br>roller; place last on<br>conveyor                             | 0.210 | 2 | 0.105 | 96.3 |
| 6  | Take last from conveyor;<br>grasp thin counter, lay<br>on and roll up with<br>roller; place last on<br>conveyor                              | 0.419 | 4 | 0.105 | 96.3 |
| 7  | Take last from conveyor;<br>grasp spur, lay on and<br>roll up with roller;<br>place last on conveyor   | 0.206 | 2 | 0.103 | 94.5 |
| 8  | Grasp rubber reinforce-<br>ments, lay them out and<br>daub; take last and<br>lay reinforcements on<br>toe. Place last on<br>conveyor         | 0.192 | 2 | 0.096 | 88.1 |
| 9  | as above, but laying<br>reinforcing on counter   | 0.192 | 2 | 0.096 | 88.1 |
| 10 | Take last and black<br>insole, lay on insole<br>and roll up; place<br>last on conveyor   | 0.202 | 2 | 0.101 | 92.6 |
| 11 | Take last and coat with<br>glue under first layer<br>of rubber. Place last<br>on conveyor  | 0.178 | 2 | 0.089 | 81.7 |
| 12 | Take last and first<br>rubber layer;<br>coat first rubber<br>layer with glue<br>and lay on stitch of<br>back seam; place<br>last on conveyor | 0.858 | 8 | 0.106 | 97.2 |

|    |   |       |   |       |      |
|----|---|-------|---|-------|------|
| 13 | Take last and trim excess off first rubber layer; place last on conveyor        | 0.196 | 2 | 0.098 | 89.9 |
| 14 | Impress of components on machine  | 0.187 | 2 | 0.093 | 85.3 |
| 15 | Take last, roll up sides; place last on conveyor                                | 0.205 | 2 | 0.102 | 93.0 |
| 16 | Take last, stitch components; place last on conveyor                            | 0.203 | 2 | 0.101 | 92.6 |
| 17 | Take last and coat with glue under sole; stand last                             | 0.181 | 2 | 0.090 | 82.6 |
| 18 | Daub sole   | 0.182 | 2 | 0.091 | 83.5 |
| 19 | Lay sole on last  | 0.207 | 2 | 0.103 | 95.0 |
| 20 | Grasp last, set it on pressing machine and roll up sole; place last on conveyor | 0.107 | 1 | 0.107 | 98.0 |
| 21 | Take last, stitch along welt of sole; place last on conveyor                    | 0.418 | 4 | 0.105 | 96.5 |
| 22 | Repair defects  | 0.210 | 2 | 0.105 | 96.5 |

|  |        | Totals |    | Averages   |
|--|--------|--------|----|------------|
|  | Totals | 5.521  | 54 | 0.102 93.0 |

The process for the assembly of rubber footwear was so divided that the lengths of individual operations were about equal to each other; this makes it possible to distribute the operations equally among individual workers. Usually, operations are selected according to the time it takes to complete them so that a specific operation could be performed by an even number of workers, for example, two, four, etc. Under these conditions, every individual operation in the assembly of footwear would have to be completed at the same time by each worker. However, as the Table shows, the lengths

of operations performed by each worker range from 0.090 to 0.109 minutes.

The capacity of the conveyor is determined by the length of the most labor consuming operation (0.109 minutes).

The output rate is calculated by the following formula:

$$N_{out.} = \frac{T - T_o}{T_{TS}}$$

where  $T$  = length of shift (420 minutes);

$T_o$  = length of rest period (20 minutes);

$T_{TS}$  = length of assembly of one pair of footwear.

$$N_{out} = \frac{420 - 20}{0.109} = 3,670 \text{ pairs of footwear.}$$

### 11. Peculiarities of Rate Setting for Multiple Equipment Use.

Multiple use of equipment is widely practiced in the chemical industry. This is possible because workers are often inactive during a technological process, since it may not require any supervision or watching. Multiple use of equipment is the simultaneous operation of several pieces of equipment by one worker or brigade of workers.

With multiple use of equipment the worker can supervise two or more pieces of equipment performing the same operation or apparatus that perform successive operations. The dependence of output rates on service rates varies with the two situations.

If the worker is operating the apparatus performing the same function, then the output rate is proportional to the service rate. Let us assume that the normal productivity of a dryer is 300 kg per shift, and the service rate is four dryers. Then the output rate is  $300 \times 4 = 1,300$  kg of product per shift. If the number of dryers serviced is increased or decreased, the output rate changes proportionally. For example, if one worker is operating six dryers then the output rate grows to  $300 \times 6 = 1,800$  kg of product per shift.

When the equipment serviced forms a unit process (for example, saturators, emulsifiers, dilators, settling basins, centrifuges and others in the production of ammonium sulfate; or filters, vaporizers, steam superheaters, contact apparatus, refrigerators, gas separators and others in the production of acetone) the output rate is determined by the apparatus which yields the final product, that is, it is equi-

valent to the productivity of the section. If the section is operated by several workers during a shift then this output rate is effective for each of them. For example, the output rate for fluosilicate of sodium of 3.1 tons per shift is effective for the machinery attendant, for workers at the absorption, centrifugal and dissolution apparatus, for the dryer and the refueler. Increasing or decreasing the number of workers has no influence on the degree of production quota.

A change to multiple equipment use servicing should not create lowering the quality of operation and a decrease in equipment efficiency.

A change to multiple equipment use operation may be effected under conditions when

$$t_p \geq \sum t_3$$

where  $t_p$  = processing time without active supervision (automatic machine time);

$\sum t_3$  = time when the worker is actually occupied, that is, the worker's time in performing his apparatus servicing functions (manual time).

The time when the worker is actually occupied includes his time spent in executing the technological process in accordance with the established routine (the feed-in of reagents into apparatus, volume measurements, sampling, watching temperature and pressure, filling in operational records), and the time spent in walking from one apparatus to another.

The number of apparatus which can be serviced by one worker or brigade of workers is determined with the formula

$$M = \frac{t_p + 1}{\sum t_3}$$

Let us assume that  $t_p = 10$  minutes,  $t_3 = 5$  minutes, then the number of apparatus which can be serviced simultaneously will be

$$M = \frac{10}{5} + 1 = 3$$

A more simple case of multiple equipment use is the simultaneous operation of identical apparatus performing one and the same operation. Fig. 11 serves as an example. Time of the operation  $T_{op} = 12$  minutes;  $t_p = 8$  minutes;  $t_3 = 4$  minutes.

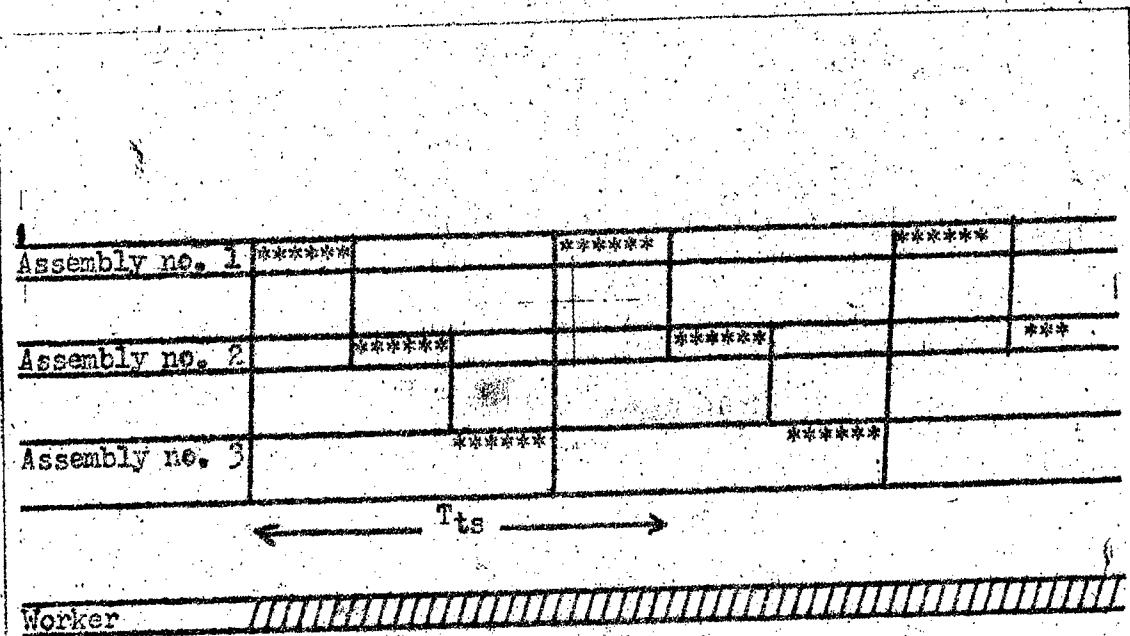


Fig. 11. Graph showing multiple equipment use of three identical apparatus.

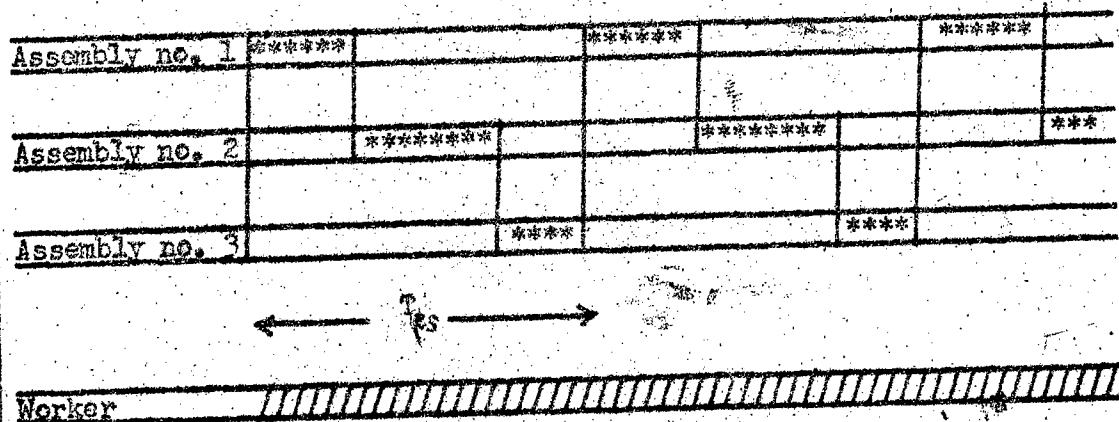


Fig. 12. Graph showing multiple equipment use of three apparatus with operations of equal length.

As evident from the graph (fig. 11) all the regularly repetitive work on the apparatus is performed during a 12 minute period.

The period during which all regularly repetitive work is completed on the combined apparatus is called the "cycle of multiple equipment use" period.

In the above example the multiple equipment use cycle is

$$T_{ts} = t_3 M = 4 \times 3 = 12 \text{ minutes}$$

The factor of the worker's engagement is determined by the ratio of the sum of manual labor time for all combined apparatus to the cycle of multiple equipment use:

$$\frac{K}{ZAG} = \frac{\sum t_z}{T_{ts}}$$

When the quotient of  $t_p$  divided by  $t_z$  is a whole number, the worker is using his time at 100% efficiency (as is shown on the graph). The worker's complete engagement is achieved when operations of equal length are performed on combined apparatus, but with different values of  $t_p$  and  $t_z$ . If 12 minute operations are performed in all three apparatus and at the same time  $t_p$  and  $t_z$  (see fig. 12) have the following lengths:

| APPARATUS N      |             |
|------------------|-------------|
| Apparatus No     | ..... 1 2 3 |
| $t_p$ minutes    | ..... 8 7 9 |
| $t_{ts}$ minutes | ..... 4 5 3 |

$$\text{then } T_{ts} = T_{op.1} = T_{op.3} = \sum t_z$$

that is, all apparatus are operating without any idle periods and the worker is fully occupied.

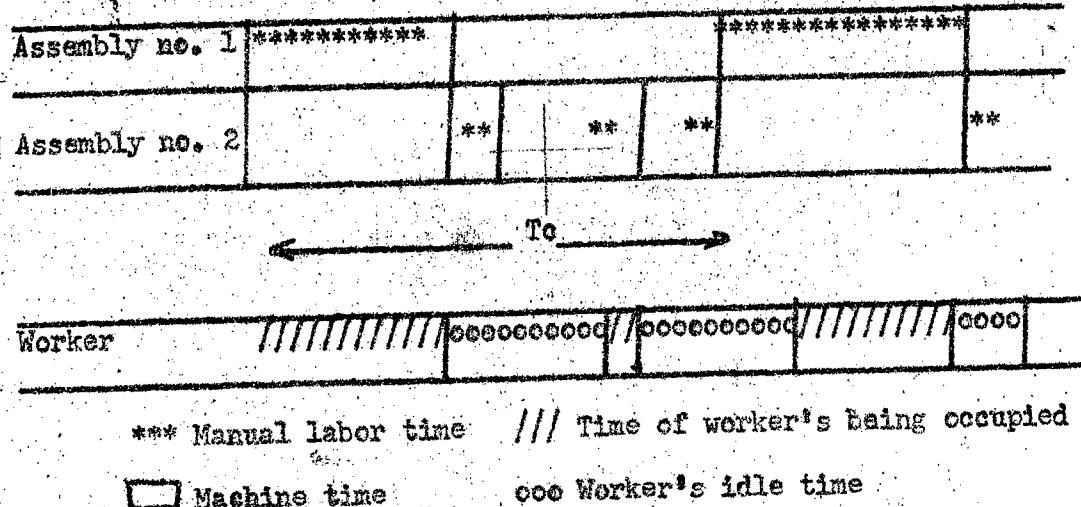


Fig. 13. Graph shewing multi-apparatus servicing of two apparatus with operations of divisible length.

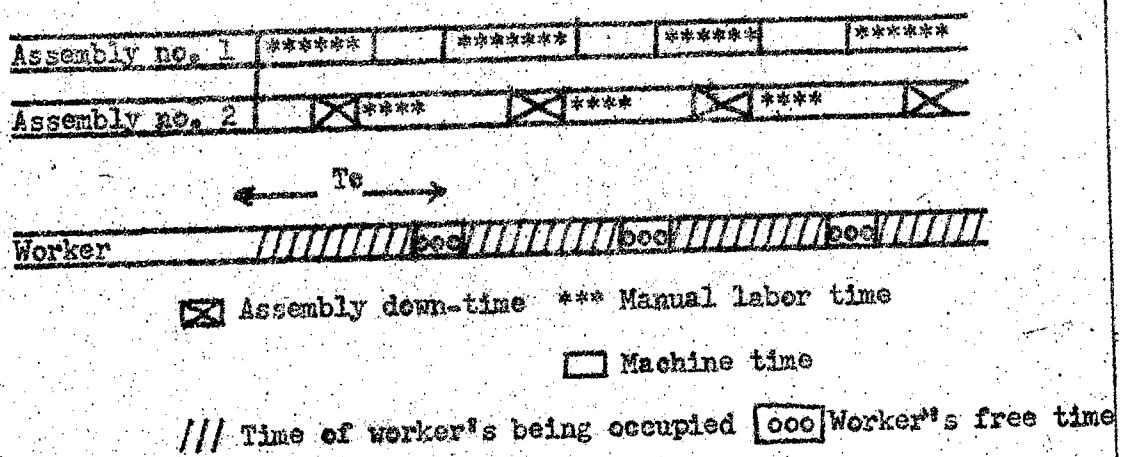


Fig. 14. Graph shewing multiple equipment use of two apparatus with operations of different lengths.

The apparatus do not have any idle periods even when operations are of short duration (fig. 13).

If the lengths of the operations at combined apparatus are divisible one by another then the length of the multiple equipment use cycle is determined by the longest operation. In this case it is not always possible to achieve uniform and full involvement of the worker during the period of the cycle.

In the example shown, the operation of two apparatus have the following duration:

Apparatus No ..... 1 2

$t_{op}$  minutes ..... 21 7

$t_p$  minutes ..... 15 6

$t_z$  minutes ..... 6 1

During the length of the cycle the second apparatus processes not one, but three products.

When organizing multiple equipment use operations, it is best to select operations having the same multiple relationship (for example, 2 or 3). In a contrasting situation the workers functional pattern becomes complicated and down-times will results.

When combining operations with different and non-multiple duration it is difficult to assure the uninterrupted operation of all apparatus.

In this example (fig. 14) operations with the following lengths are being performed on two apparatus:

Apparatus No ..... 1 2

$t_{op}$  minutes ..... 9 7

$t_p$  minutes ..... 5 4

$t_z$  minutes ..... 4 3

The cycle of multi-equipment operation is determined by the longest operation. As evident from the graph:

$$T_z = T_{op \ max.} = t_p = t_{op}$$

Down-time of each apparatus would be:

$$T_{dt} = T_{ts} = T_{op.}$$

In our example, apparatus down-time would be  $9 - 7 = 2$  minutes in each cycle and the worker would be occupied only during

$$\frac{4+3}{9} \times 100 = 77.7\% \text{ of his time at work.}$$

When organizing multiple equipment use it is best to strive for combinations of operations and equipment under which the peak loading of all equipment and complete engagement of all workers will be assured.

## 12. Procedure for a Revision of Production Norms.

The production norms established in a plant shop with the participation of peredoviks are approved by the director of the enterprise. The approved production norms are compulsory, and noone has the right to change them without a special permission from the director of the enterprise.

Under the conditions of the development of socialist competition, continuous raising of the workers' qualification and systematic improvement of technique and technology, the established production norms after a certain period of time become obsolete and fail to meet the technical and production-engineering level attained.

The application of under-rated production norms causes wage disparity to individual groups of workers and over-expenditure of the wage fund; it is, therefore, necessary to revise production norms regularly.

Previously, production norms at enterprises were revised annually on a general basis (as a rule, in January-February), in accordance with centralized work quotas provided in annual national-economy plans. Such an order of revision of production norms had a number of essential draw-backs. The senior organizations were practically unable to take into account the internal reserves of an enterprise for production development, and were mainly oriented by general information with regard to the fulfillment of a plan for the development of work productivity and factual overfulfillment of production norms. As a result, the under-rated production norms of enterprises were overlooked, initiative and the responsibility of the key personnel of the enterprises for development or work-productivity reserves were held back, and no conditions were created for any improvement in the quality of work standardization.

A general revision of production norms at all once proved ineffective if even because of the fact that it was not coordinated with the introduction of new technique, improvement in production technology and development of work scheduling, all of which were being carried out not at any strictly defined time for all enterprises, but throughout the course of the entire year for each individual plant.

The management of many plants and shops, as well as the foremen, by carrying out such work without any appropriate revision of production norms, hindered the growth of work productivity and created an incorrect ratio between the growth of work productivity and the rate of pay among individual groups of workers.

Because of extremely short time limits (1-2 months) allowed for general revision of many thousands of production norms, the latter were not always technically substantiated; it was, moreover, impossible to carry out all the necessary industrial engineering measures directed toward an increase in the work productivity. Thus, out of 4,900 suggestions for the increase of work productivity made by workers as well as technical and engineering personnel of enterprises in the chemical industry during the revision of production norms in 1955, only 1,500 suggestions were adopted. At the same time delays in the achievement of the proposed production engineering measures in a number of cases led to a temporary unwarranted and reduced earnings in some categories of workers.

In accordance with the decisions of the XXth Congress of the KPSS (Kommunisticheskaya Partiya Sovetskogo Soyuza - - Communist Party of the Soviet Union) with regard to the necessity of a wide introduction of technically-substantiated production norms in accordance with the technological and production engineering level, the Council of Ministers of the USSR adopted a resolution "on the Modification of the Revision of Production Norms." Instead of a general simultaneous revision of production norms as pertinent to centralized quotas, a revision of norms by sections and types of work at times planned by the individual enterprises was introduced. Furthermore, each enterprise develops a calendar-year plan for the revision of norms on the basis of quotas, based on the progress of work productivity, the planned level of average wage, and a plan for lowering production costs. New norms are introduced strictly in accordance with a program for the achievement of technical, economic and organizational measures which guarantee the growth of work productivity and reduction of a labor-consuming nature of production.

The participation of all workers as well as of engineering and technical personnel in the formulation of these plans insures a practical approach to the date set for achievement of the measures therein planned.

The matter of an increase in production norms and the dates for the introduction of new norms are coordinated by the plant management with the plant committees of the trade unions.

The pattern for the revision of production norms solely on the basis of the achievement of the corresponding technical, economic and organizational measures by no means signifies that such measures are required for every individual norm. Usually, as a result of the achievement of the recommended measures, the labor-consuming nature of a number of operations is lowered. In such cases it is necessary to revise all the production norms for these operations simultaneously.

The rejection of the system of revising production norms in short (campaign-type) time periods and carrying out systematic work throughout an entire year for the improvement of production and labor management, the development and introduction of technically-substantiated production norms helps promote a further increase in work productivity, with a simultaneous rise in the workers' earnings. The plant trade-union committees must follow strictly the timely achievement of the proposed industrial engineering measures. If such a measure promotes the increase in the work productivity and is carried out according to a rationalized suggestion on the part of a worker, then a premium is paid to that worker for the suggestion, and, in addition to that, for a period of six months from the date of the acceptance of the suggestion he is paid the difference between the old and the new rate.

New production norms and piece rates are announced to the workers in advance and posted in work areas.

#### PROBLEMS

1. Calculate single shift production output quota of a polymer from the following data. Polymerization time - 42 hours; total weight of a batch poured from a polymerization kettle is 600 kg; single female worker attends 12 kettles.

2. Calculate single shift production norm for the preparation of an electrode mass in a vacuum mixer from the following data:

|   |         |
|---|---------|
| Change-over time of a shift                       | 10 min. |
| Time required to load a mixer with ingredients    | 9 " "   |
| Processing of a mixture according to instructions | 60 "    |
| Unloading ready mass                              | 5 "     |
| Weight of a mass for a single operation           | 800 kg  |

3. Calculate single shift production quota of vulcanization of automobile inner tubes from the following data:

Pre-heating time of a machine 5 min.

Vulcanizing time 11 "

Exhaust steam 2.8 "

Recharging time 4.9 "

Thirty-two inner tubes are loaded into a single machine.  
Single brigade operates three machines.

## Chapter Five

### Workers' Wage and Salary Organization.

#### 1. The Economic Law of Distribution According to Labor.

The classification of products by the amount and quality of labor expended is one of the economic laws of socialism.

Classification according to labor promotes proper coordination of the personal and social interests of the workers, creates a material interest on the part of each worker in the results of his labor and speed-up the development of the productive resources of a socialistic society.

The method of classification of products in a society is determined entirely by the method of production and changes depending on the nature of social production and of the historical stage of its development.

In a capitalist society, which is based on private ownership at the expense of production and exploitation of one person by another, the classification of products is made in the interests of the exploiting classes, which appropriate for themselves the major portion of the social labor production in the form of surplus value.

In a socialist society the means of production are public property and the distribution of a socially-owned product is made in the interests of the workers. Each worker's share in a socially owned product is determined by the amount and quality of his labor.

Among the workers of enterprises and institutions the classification of production goods is realized in the form of wages and salaries.

In the USSR the wage level for workers depends first of all on the level of labor productivity. The higher the labor productivity

and the production volume, the more consumer goods does the socialist society receive and the more the consumer goods reserve increases.

The continuous improvement in the material welfare of the Soviet people may serve as a striking illustration of the above. On the basis of a successful restoration and development of heavy industry and of the entire national economy, as well as of a growth of work productivity, the Soviet government has also carried out important measures, such as improvement of the pension maintenance of workers, increased wages for low-salaried categories of workers and office personnel, shortening of the work hours on the eve of a holiday or day off. A shortened work day for workers and professional personnel in some individual branches of industry, the establishment of a six-hour and four-hour working day for juveniles, etc. As a result, a significant improvement has been brought about in the material welfare of workers, and conditions for a further increase in labor productivity and advancement of socialist economy have been created.

For a continuous development of a socialist society it is necessary that the increase in work productivity remain continuously ahead of the increase of the wages. Only on that condition can society obtain the required resources for the expansion of production and the more complete satisfaction of the workers' needs.

The increase in work productivity and the increase in the production volume in the USSR are accompanied by the growth of the wage fund and of the average earnings of workers.

It should be taken in consideration that in a socialist society, besides those wages which are paid to workers directly, huge funds are expended by the socialist government for general social and cultural measures.

The government's expenditures on the pension maintenance of workers, on free medical aid and on schools, technical schools and higher education institutions on the raising of qualification standards, on the maintenance of institutions for children, grant allowances to large families, vacations and free passes to sanatoriums and rest homes raise the real income of workers and other personnel by approximately one-third over what they receive in the form of annual wages. As shown in Table 15, the government's expenditures for all these purposes are continuously increasing.

In 1958 over 215 billion rubles were spent on payments of social security insurance, grants, pensions, scholarships, free tuition, medical service, vacation expenses, expenses in connection with boarding schools, maintenance costs of kindergartens, nurseries, sanatoriums, rest houses, homes for the aged, and other payments and privileges. According to the Seven-Year Plan, expenses for the above purposes will be in the year 1965 increased to approximately 360 billion rubles and will amount to about 3,800 rubles for each worker.

annually. Furthermore, more than 800 rubles a year will be spent for each worker for the construction of housing facilities, schools, medical institutions and those for the improvement of living conditions. By the end of the Seven-Year Plan all these measures will ensure a 40% increase per capita in the real incomes of workers and other personnel. In conjunction with this the information on the additional expenditures of employers in the prewar years for the care of workers is indicative. According to the data of Academician S. G. Strumilin (Problems of Labor Economics, Gospolitezdat, 1957, p. 455), in 1900, as against total wages of 278 million rubles paid, the monies industry spent for the care of workers amounted to 13,195,000 rubles, or 4.75%, including:

|                           |                  |         |
|---------------------------|------------------|---------|
| Upkeep of living quarters | 4,869,000 rubles | - 1.75% |
| Medical aid               | 4,607,000 "      | - 1.66% |
| Workers' insurance        | 1,464,000 "      | - 0.53% |
| Upkeep of schools         | 1,066,000 "      | - 0.38% |
| Other facilities          | 1,189,000 "      | - 0.43% |

Table 15

Amount of Payments and Privileges Received by the Population of the USSR from the Government Budget and from the Funds of Enterprises (in billion rubles)

|                                | Years |       |       |
|--------------------------------|-------|-------|-------|
|                                | 1940  | 1950  | 1955  |
| Total                          | 42.0  | 122.0 | 154.0 |
| Including:                     |       |       |       |
| Expenditures for education     | 17.6  | 46.5  | 54.6  |
| Expenditures for public health | 8.0   | 19.8  | 29.2  |
| Old Age and invalid pensions   | 3.3   | 24.3  | 29.7  |

|   |     |      |      |
|---|-----|------|------|
| Temporary disability assistance   | 2.2 | 5.5  | 6.9  |
| Allowances to single mothers and large families   | 1.2 | 3.7  | 5.0  |
| Other social-security expenditures (traveling expenses, up-keep of Pioneer summer camps, etc.)          | 2.3 | 5.6  | 6.3  |
| Extraordinary premiums not included in the wage and salary fund (plant funds and other incentive funds) | 0.5 | 1.5  | 1.9  |
| Vacation pay to workers and other personnel   | 6.4 | 14.5 | 19.5 |

Only a socialist state displays such tireless concern for the level of the living standards of workers and is able to allot such substantial funds for the betterment of the life of its citizens.

## 2. Wage and Salary System

The workers' wages are regulated by a wage and salary system that includes wage rates, wage scales and wage and job classification manuals.

### Wage Scale Rates

The rates of the wage scale determine the level of the workers' wages by the hour or by the day. Wage scale rates for each branch of industry are approved by the government. They depend on the following:

- 1) the importance of the branch of industry to the national economy;
- 2) the geographic location of the enterprises;
- 3) labor conditions;
- 4) wages system and other factors.

For workers in key branches of industry (metallurgical, petroleum, chemical, coal mining) higher wage-scale rates are established,

which promotes a buildup of permanent personnel in the principal branches of industry.

For purposes of insuring advantages in earnings for workers employed in enterprises in eastern and northern rayons of the country where difficult climatic conditions prevail, in addition to the normal wages rayonnyy allowance factors are established.

The rayonnyy allowance factors have been established on the following scale:

In Far North rayons, 1.60

In remote northern rayons 1.40

In some rayons of Eastern Siberia and the Far East 1.20

In some rayons of the Urals,  
Western Siberia,  
Kazakhstan and Central Asia 1.10

Wage rates depend also on working conditions. Higher rates are established for persons working in hazardous and extremely hazardous environments.

Thus, for workers the enterprises of the chemical industry the wage rate of the first category for a seven-hour working day is established as follows: under normal working conditions for piece-work 17 rub. 80 kop. and for workers paid by the hour 15 rub. 70 kop; for persons working under hazardous conditions 20 rub. 10 kop. and 17 rub. 80 kop, respectively, and for those working under extremely hazardous conditions -- 23 rub. 60 kop. and 21 rub. 30 kop.

The list products in the chemical industry where workers are paid according to wage scales established for work under hazardous and difficult, extremely hazardous and extremely difficult working conditions, have been approved by the Government Committee of the Council of Ministers of the USSR for Labor and Wage Problems and VTsSPS.

In accordance with the above mentioned lists workers employed in the production of sulfuric acid, chloride and calcium hypochlorite, aluminum chloride, zinc chloride, calcium chloride, phosphorus, ammonia, etc., are paid according to wage rates for hazardous working conditions.

The scale of wage rates for extremely hazardous working conditions is applied to workers engaged in the production of phosgene, carbon bisulfide, hydrogen fluoride, zinc dust, etc.

Furthermore, for those working under hazardous conditions a shorter working day is scheduled, additional holidays, free fats

and milk rations are provided.

The level of the wage rate depends also on the wage and salary system. For persons doing piece-work, whose labor is more intensive than that of persons receiving hourly wages, increased wage rates (by 10-15%) are established.

As a rule, wage rates are established for a worker of the first category for a normal-length working day.

Table 16 adduces data on the wage rates for workers in the chemical industry under different working conditions.

Hourly rates are determined by dividing the daily rate by the established length of a working day.

Thus, for the determination of the hourly rate of the first category with a normal length of the working day (seven hours) the daily rate of 15 rub. 70 kop. is divided by seven ( $15.70 : 7 = 2$ ) rub. 24 kop. With an established length of a working day of six hours the hourly rate amounts to 17 rub. 80 kop.:  $6 = 2$  rub. 96 kop.

Table 16

Daily Wage Rates for Workers Under Normal, Hazardous  
and Extremely Hazardous Conditions

| Working<br>Conditions          | Categories |       |       |       |       |       |       |
|--------------------------------|------------|-------|-------|-------|-------|-------|-------|
|                                | Factors    |       |       |       |       |       |       |
|                                | I          | II    | III   | IV    | V     | VI    | VII   |
|                                | 1.0        | 1.14  | 1.30  | 1.49  | 1.71  | 1.98  | 2.3   |
| Wage rates, rub. kop.          |            |       |       |       |       |       |       |
| For workers on<br>hourly basis |            |       |       |       |       |       |       |
| A                              | 15-70      | 17-90 | 20-41 | 23-39 | 26-85 | 31-09 | 36-11 |
| B                              | 17-80      | 20-29 | 23-14 | 26-52 | 30-44 | 35-24 | 40-94 |
| C                              | 21-30      | 24-28 | 27-69 | 31-74 | 36-42 | 42-17 | 49-00 |
| For piece-<br>workers          |            |       |       |       |       |       |       |
| D                              | 17-80      | 20-29 | 23-14 | 26-52 | 30-44 | 35-24 | 40-94 |
| E                              | 20-10      | 22-91 | 26-13 | 29-95 | 34-37 | 39-80 | 46-23 |
| F                              | 23-60      | 26-90 | 30-68 | 35-16 | 40-36 | 46-73 | 54-28 |

Legend: A - Under normal working conditions  
 B - Under hazardous and difficult working conditions  
 C - Under extremely hazardous and extremely difficult  
 working conditions  
 D - Under normal working conditions  
 E - Under hazardous and difficult working conditions  
 F - Under extremely hazardous and extremely difficult  
 working conditions

### Wage and Salary Scale

Wage and salary scales serve for the determination of ratios in the wages of workers of various qualifications. A wage and salary scale represents a chart (scale factors) by which the difference in the wages paid to workers of different qualifications are determined.

Wage-scale factors determine how many times the wage rate of a worker in a given category exceeds the wage rate for a worker of the first category. The scale factor of the first category is assumed as equal to the unit.

The following wage scale is applied in enterprises of the chemical industry:

| Categories | I   | II   | III  | IV   | V    | VI   | VII |
|------------|-----|------|------|------|------|------|-----|
| Factor     | 1.0 | 1.14 | 1.30 | 1.49 | 1.71 | 1.98 | 2.3 |

The ratio between the wage rates for the seventh and first categories of the above scale is 2.3. The wage rate for the seventh category is 2.3 times as high as the rate for the first category; the rate for the fifth category is 1.71 times as high as the rate for the first category.

Knowing the wage rate for the first category and the wage scale, one may calculate the wage rate for a worker of any category. (See Table 16).

### Wage and Job Classification Manuals

The application of a wage scale category to a worker and the determination of the work category is made on the basis of the wage and job classification manuals. The manuals show detailed production characteristics of all types of work encountered in a given branch of industry, enumerate all requirements applicable to a worker (professional habits, required knowledge, etc.) and the applicable wage categories.

The wage and job classification manuals currently effective in enterprises of the chemical industry were approved in 1958 by the Gosudarstvennyy komitet (Government committee) of the Soviet of Ministers USSR on labor and wage problems in agreement with the

Central Committee of the trade Union of workers of the oil and chemical industries.

The approved wage and job classification manuals are compulsory for all enterprises of the given branch of industry.

With further progress in development and perfection of technique and technology, familiarization with new types of production as well as changes in working conditions, the wage and job classification manuals are being modified and supplemented.

The right to introduce into the manuals any changes of their own have not been granted to the enterprises, since this could lead to lack of coordination in the wages of workers with equal qualifications working in similar enterprises. Modifications and additions in the manuals are approved by the State Committee of the Soviet of Ministers of the USSR on problems of labor and wages in agreement with the Central Committee of the trade union.

Uniform qualification characteristics of the equipment operator are adduced as an example.

#### Senior Equipment Operator

##### Job Description

Performs supervision of the technological process for the section he is responsible for, in accordance with working instructions. Starts and stops apparatuses, machines and other equipment being used. Supervises the functions of the equipment for the entire section. Controls the observance of technological regulations, the output and quality of the product in all stages of his section by means of process instrumentation and by the results of chemical analyses. Regulates batching processes, supply and loading of raw materials, intermediate and finished products. Prevents and eliminates the causes of deviations from the norms of the technological regime. Prevents interruptions in the function of equipment and communications. Directs workers under him. Selects samples for control of production. Performs control analyses in his section, as specified by the work rules. Calculates the quantity of raw materials required and of the output of finished products. Performs simple repairs of apparatuses and communications.

##### Must know (be familiar with)

The technological pattern of product manufactured. Construction, principal function and operating rules of the main and auxiliary equipment, process instrumentation, electric wiring and communications.

The physico-chemical and technological properties of the raw materials, half-finished products, finished products, as well as of the technological fuels, lubricants and other auxiliary materials, GOST's (Gosudarstvennyy Obshche-Soyuznyy Standart -- National Soviet Industrial Standard) and technical requirements for the raw materials and finished products.

The physico-chemical principles and nature of the technological process for his section. The routine technological regime and rules for the regulation of the process. Types of discards, their causes, preventive measures for their elimination. The methodology of analyses required for control of the given process.

Wage category -- VI.

For operating responsible and complex processes involving higher technical and fire-safety requirements, for operating complex equipment using expensive raw materials, when a higher qualification, skill and thoroughness in the performance of the processes is required.

Wage category -- VI.

For operating especially important and complex processes and equipment, connected with the processing of explosive, inflammable as well as of toxic and burning substances, for the operation of automatized sections, productions with the use of high pressures, or complex experimental installations.

Wage category -- VII.

#### Equipment Operator

##### Job Description

Performs technological process in accordance with the work rules. Starts and stops the apparatuses and other equipment being operated. Loads raw materials, delivers and unloads finished and intermediate product. Discovers and eliminates irregularities in the function of equipment and communications. Maintains, in accordance with the technological regime, batching of raw materials, temperature, pressure, vacuum and other process-performance indicators. Regulates technological process by means of process instrumentation and by the results of analyses. Selects samples for production control and performs analyses required by the work rules.

Maintains inventory of raw materials and intermediate products, of the amount of production output and is responsible for the appropriate entries in production records. Performs simple calculations of the expenditure of raw materials and of production

output. Directs workers under him. Carries out minor repair of equipment.

Must know

Technological layout of his section, construction, general function and operating rules of the main and auxiliary equipment, process instrumentation, electric wiring and communications at his working place.

The physico-mechanical and technological properties of raw materials, intermediate products, finished products, as well as of the technological fuels, lubricants and other auxiliary materials.

Required qualities of raw materials, GOST's and technical requirements for raw materials and finished products.

The physico-chemical principles and nature of the technological process at his work place. The routine technological regime and rules of the process regulation.

Wage category -- V.

For operating especially responsible and complex or multi-phase technological processes requiring greater thoroughness in regulating the technological regime within the range of temperature, pressure, batching, etc.

Wage category -- VI

For operating of especially responsible and complex processes involving increased knowledge of technical and fire-safety regulations connected with the processing of explosive, inflammable, as well as toxic and burning substances. For operation with especially complex equipment using expensive raw materials, in cases when increased qualifications, skill and thoroughness in the performance of the process are required.

Wage category -- VII.

For the performance of technological processes or their individual stages, the established regime for which permits deviations in the temperature, pressure, vacuum, dosage and other indicators, or operating certain processes under the direction of equipment operators possessing high qualifications.

Wage category -- IV.

## Assistant Equipment Operator

### Job Description

Performs separate operations of the technological process under the direction and control of the equipment operator. Performs additional assignments. Prepares, loads and unloads raw materials. Starts and stops apparatuses, pumps, motors, conveyors and other machinery being used under the direction of an equipment operator. Operates process instrumentation. Selects samples for production control. Estimates quantities of raw materials and finished products. Cleans and lubricates apparatuses and mechanisms.

### Must know

Construction, general functions and operating rules of the main and auxiliary equipment, electric wiring and communications at his work place. The purpose of the process instrumentation and the meaning of its readings. Nature and working condition of the technological process.

### Wage category -- IV.

When temporarily assuming duties of an equipment operator who is classified in the fourth category.

### Wage category -- III.

Wage categories are established in accordance with the job descriptions and prerequisites of individual occupations. Thus the following wage categories have been established:

In the manufacture of sulfuric acid:

|  |    |
|--|----|
| Senior equipment operator of the furnace unit  | VI |
| Equipment operator of the furnace unit         | V  |
| Equipment operator of the recovery unit        | IV |
| Senior equipment operator of the tower unit    | VI |
| Equipment operator of the tower unit           | V  |
| Assistant equipment operator of the tower unit | IV |

In the manufacture of weak nitric acid:

Senior equipment operator of contact apparatuses VII

Equipment operator of contact apparatuses V

Equipment operator of contact apparatuses and absorption columns V

Equipment operator of heat transfer tower IV

For every newly-employed worker a wage category is established in accordance with the wage and job classification manual, corresponding to the work to be performed and worker's qualifications. The establishment of the wage category for a worker is effected by an order in the shop (a copy of the order being directed to the accounting department and to the personnel department).

### 3. Wage Payment Systems

Wage systems should stimulate an increase in work productivity, improvement of the quality of products and lowering of production cost.

In enterprises of the chemical industry two principal wage payment systems are used: the piece wage system and the hourly wage system.

#### Piece Wage System

With a piece wage system the worker's earnings depend directly on the quantity and quality of the work performed. One should therefore always strive to transfer to the piece wage system all workers for whom production norms or time standards can be established.

The piece wage system is the most widely used in socialist industry, and the number of workers paid in accordance with the piece wage system increases from year to year. In enterprises of the chemical industry, over 60% of the workers are paid on the basis of the piece wage system.

Depending on the work scheduling and type of production accounting, piece wages may be individual or brigade (collective).

The best type is individual wages, in which case the production and evaluating norms are established for each individual worker and wages are calculated for each person depending on the fulfillment by him of the established production output norm.

This form of wage payments corresponds most fully to the socialist principle of wages paid according to work performed, and it should, therefore, be used in all cases where individual pro-

duction norms can be established.

The brigade (collective) form of wage payments is used in those cases where owing to the conditions of the production process the work is performed by a brigade (group of workers) and the results of the work performed by each one cannot be assessed separately from the results of the work of other workers.

The brigade form of wage payments lowers the interest of individual workers in increasing work productivity. Since a worker's wage is not in any direct dependence on his individual output performance, but depends on the results of the work of the entire brigade. Therefore, wherever conditions permit, the substitution of the individual piece-work for brigade piece-work should be introduced.

Piece wages are applied in the form of straight piece wages and progressive piece wages.

With straight piece wages payments are made to workers according to a firm price for every unit of finished, acceptable production, regardless of the level of fulfillment of output norms. The piece-work unit price is determined by dividing the day (shift) wage rate established for the given work by the output norm:

$$R = \frac{T_{\text{unit}}}{N_{\text{prod.}}}$$

where  $R$  is the piece-work rate per unit of production;

$T_{\text{unit}}$  is the day wage rate of piece worker of the respective category;

$N_{\text{prod.}}$  is the established daily output norm.

Examples. 1. For a worker operating a salt crusher classified in the third category (according to the wage scale under normal working conditions, Table 16) a production output of 5 tons of salt for one shift has been established.

The rate per one ton of salt will be:

23 rub. 14 kop. : 5 = 4 rub. 63 kop.

2. For a worker transporting pyrite paid according to the second category (according to the wage scale, under hazardous working conditions, Table 16), a piece-work output norm of 8 tons of pyrite for one shift (to be loaded into a push cart, pushed to an elevator, and loaded into the elevator) is established.

The unit rate for one ton of pyrite would be:

$$22 \text{ rub. } 91 \text{ kop.} : 8 = 2 \text{ rub. } 86 \text{ kop.}$$

If a standard time unit (in hours or fractions of an hour) is prescribed instead of an output norm (in pieces, tons), as is sometimes done in mechanical repair shops, then the piece wage rate is computed as follows:

$$R = T_h \times N_{\text{time}}$$

where  $T_h$  is the wage scale rate for a piece-worker per hour;

$N_{\text{time}}$  is the standard time unit.

Example. For the manufacture of a detail a standard time unit of 4 hours is established. The work is rated according to the sixth category (according to the wage scale - under normal working conditions, Table 16). The hourly rate is 5 rub. 03 kop.

The unit rate for the manufacture of the detail would be:

$$5 \text{ rub. } 03 \text{ kop.} \times 4 = 20 \text{ rub. } 12 \text{ kop.}$$

In those cases where in accordance with the conditions of the performance of the technological process the output norm is established for the brigade (collective), piece-work unit rates are computed for each occupation within the brigade, on the basis of the appropriate wage rates.

In such a case the rates are determined as follows:

$$P_1 = \frac{T_1}{N_{\text{brig}}} ; \quad P_2 = \frac{T_2}{N_{\text{brig}}} ; \quad P_3 = \frac{T_3}{N_{\text{brig}}} \text{ etc.}$$

where  $T_1$ ,  $T_2$  and  $T_3$  are the wage rates for the workers of the brigade;

$N_{\text{brig.}}$  is the output norm established for the brigade.

The earnings of each worker in the brigade are determined by multiplying the appropriate unit rate by the amount of product actually manufactured by the brigade in the course of one month, taking into consideration the number of hours worked by each worker.

In order to stimulate better utilization of working time and reduce the number of workers in a brigade, a supplementary control unit rate is established per one ton of production for the entire

brigade. In such a case the total combined wages for all of the members of the brigade should not exceed the total wages according to the brigade unit price.

The brigade unit rate for one ton of production would be:

$$R_{\text{brig.}} = \frac{T_1 + T_2 + T_3 + T_n}{N_{\text{brig.}}}$$

If an extra worker has temporarily been included into the brigade, the wages for that worker should be paid out of the combined total of the wages due the brigade. On the other hand, if the brigade temporarily included fewer workers than the number of workers established by the work rules, the earnings which were to be due to the absent worker are distributed among those members of the brigade who were actually working and replacing the absent member.

Examples. 1. For a brigade operating a single carbide furnace, an output norm of 18 tons of carbide for one shift has been established.

The brigade operating the furnace consists of a senior equipment operator rated according to the seventh category, three carbide tapmen, rated according to the sixth category, two furnace men, rated according to the sixth category and one equipment operator, rated according to the fifth category.

The unit rates are computed by dividing the wage rate for each worker (according to the wage scale - for hazardous working conditions, Table 16), by the total output norm; for one ton the rate would be:

for the senior equipment operator

$$46 \text{ rub. } 23 \text{ kop.} : 18 = 2 \text{ rub. } 57 \text{ kop.}$$

for the tapmen

$$39 \text{ rub. } 80 \text{ kop.} : 18 = 2 \text{ rub. } 21 \text{ kop.}$$

for the furnace men

$$39 \text{ rub. } 80 \text{ kop.} : 18 = 2 \text{ rub. } 21 \text{ kop.}$$

for the equipment operator

$$34 \text{ rub. } 37 \text{ kop.} : 18 = 1 \text{ rub. } 91 \text{ kop.}$$

If the brigade, over a period of one month, manufactures 500 tons of calcium carbide, in case the straight piece wage system is applied, the monthly earnings would be:

for the senior equipment operator

$$2 \text{ rub. } 57 \text{ kop. } \times 500 = 1,285 \text{ rub.}$$

for the tapmen

$$2 \text{ rub. } 21 \text{ kop. } \times 500 = 1,105 \text{ rub. (each)}$$

for the furnace men

$$2 \text{ rub. } 21 \text{ kop. } \times 500 = 1,105 \text{ rub. (each)}$$

for the equipment operator

$$1 \text{ rub. } 91 \text{ kop. } \times 500 = 945 \text{ rub.}$$

The total combined wages for the entire brigade would be

$$1,285 + 1,105 \times 3 + 1,105 \times 2 + 945 = 7,765$$

In the above example the unit rate for the brigade for one ton would amount to:

$$R_{\text{brig.}} = \frac{46 \text{ rub. } 23 \text{ kop.} + (39 \text{ rub. } 80 \text{ kop.} \times 3) + (39 \text{ rub. } 80 \text{ kop.} \times 2) + 34 \text{ rub. } 77 \text{ kop.}}{18}$$
$$= 15 \text{ rub. } 53 \text{ kop.}$$

For the output of 500 tons the brigade is due:

$$500 \times 15 \text{ rub. } 53 \text{ kop.} = 7,765 \text{ rub.}$$

which corresponds to the amount of wages actually received.

2. For workers of the operational department of a superphosphate shop a collective output norm of 240 tons of superphosphate for one shift has been established.

Unit rates are determined on the basis of the number of the required personnel wage categories and wage rates (Table 17).

In one month 6,500 tons of superphosphate has been manufactured, the assistant hauler (driver) did not work by reasons of illness for ten days, while his functions were performed by the senior hauler.

The actual wages computed for workers of the individual occupations are adduced in Table 18.

According to the collective unit rates (130 rub. 98 kop. for 100 tons) for the manufacture of 6,500 tons, the brigade should receive 8,513 rub. 70 kop.; actually credited 8,201 rub. 70 kop.; thus, the saving resulting from the absence from work of the assistant hauler amounts to 312 rubles. This amount is paid to the senior hauler, who performed additionally the functions of the assistant hauler.

Thus, the combined earnings of the senior hauler will amount to:

$$929 \text{ rub. } 50 \text{ kop.} + 312 \text{ rub. } 50 \text{ kop.} = 1,241 \text{ rub. } 50 \text{ kop.}$$

Table 17

Unit Rates for Workers of the Superphosphate Manufacture

| Occupation               | Number of workers per shift | Wage Category | Wage Rate per shift r. k. | Piece Rate for each 100 tons of Superphosphate r. k. |
|--------------------------|-----------------------------|---------------|---------------------------|--|
| Sr. mixer                | 1                           | VII           | 46-23                     | 19-26  |
| Mixer                    | 1                           | VI            | 39-80                     | 16-60  |
| Sr. unloader             | 1                           | VI            | 39-80                     | 16-60  |
| Asst. unloader           | 1                           | IV            | 29-95                     | 12-48  |
| Stocker                  | 1                           | V             | 34-37                     | 14-30  |
| Sr. Hauler               | 1                           | V             | 34-37                     | 14-30  |
| Asst. hauler             | 1                           | IV            | 29-95                     | 12-48  |
| Pan mixer operator       | 1                           | IV            | 29-95                     | 12-48  |
| Screw conveyor attendant | 1                           | IV            | 29-95                     | 12-48  |
| Total                    | 9                           | -             | -                         | 130-98   |

Table 18

## Actual Earnings of Workers by Occupations

| Occupation               | Number of Workers | Days Worked per shift | Unit Rate per ton r. k. | Quantity Manufact. Tons | Wages due r. k. |
|--------------------------|-------------------|-----------------------|-------------------------|-------------------------|-----------------|
| Sr. mixer                | 1                 | 26                    | 19-26                   | 6,500                   | 1251-90         |
| Mixer                    | 1                 | 26                    | 16-60                   | 6,500                   | 1079-00         |
| Sr. unloader             | 1                 | 26                    | 16-60                   | 6,500                   | 1079-00         |
| Asst. unloader           | 1                 | 26                    | 12-48                   | 6,500                   | 811-20          |
| Stocker                  | 1                 | 26                    | 14-30                   | 6,500                   | 929-50          |
| Sr. hauler               | 1                 | 26                    | 14-30                   | 6,500                   | 929-50          |
| Asst. Hauler             | 1                 | 16                    | 12-48                   | 4,000                   | 499-20          |
| Pan mixer operator       | 1                 | 26                    | 12-48                   | 6,500                   | 811-20          |
| Screw conveyor attendant | 1                 | 26                    | 12-48                   | 6,500                   | 811-20          |
| <b>Total</b>             | <b>9</b>          |                       | <b>130-98</b>           |                         | <b>8201170</b>  |

One form of the piece wage system is progressive piece-work wages, in which case additional payments are made for production exceeding the established norm, according to rates increasing progressively and simultaneously with the overfulfillment of the norm. The application of progressive wages complicates the calculation of wages and frequently (with high rate of extra pay for overfulfillment of norms) increases production cost. Therefore, at enterprises of the chemical industry such a wage system is not used.

## Piece-Work Premium Wages

One of the variations of the piece wage system is the piece-work premium wage system. Its idea consists of the fact that piece rate workers, besides the regular piece wages, receive a specified premium for the fulfillment and exceeding of certain production

quantity and quality indicators. These indicators may comprise economy in raw materials as against the planned expenditure norms, increase in manufacture of first-class products over and above the plan, observance of production schedules and technological parameters, fulfillment and overfulfillment of the monthly quota by the entire assembly, section, shift, or shop, etc.

Depending on specific production conditions, premium payments may be made simultaneously for both quantity and quality indicators. However, the total number of the indicators for premium payments must not exceed two or three. Premium-payment indicators are worked out at the enterprises on the basis of the standard regulations applicable to the piece-work premium system of workers' wages at enterprises of the chemical industry, approved by the State Committee of the Council of Ministers of the USSR on problems of labor and wages and by the VTsSPS. The standard rules and regulations determine the basic order of premium payment for workers, the size of the premium and mode of payment.

Standard Rules and Regulations for Piece-Work Premium Wages for Workers at Enterprises of the Chemical Industry [Note:] Approved by the resolution of the State Committee of the Council of Ministers of the USSR on problems of labor and wages and the VTsSPS on 3 September 1958, No. 829.

The rules and regulations for the payment of premium is introduced for purposes of raising the material interest of workers in the further increase of work productivity, in the fulfillment and overfulfillment of the production goal, decrease of production cost and improvement of the quality of the product.

1. Piece rate workers of production shops are paid premiums for the fulfillment and overfulfillment of the monthly quotas by the assembly, section, shift or shop, as well as for improvement of the quality indicators, observance of production schedules and technological parameters, economy of raw materials as against the planned expenditure norms, increase of first-class production over and above the quota, adaptation of new kinds of raw and other materials.

Depending on specific production conditions, the payments of premiums may be made simultaneously for quantity and quality indicators. A premium for quality indicators is paid out on condition of fulfillment of the production plan by the operating assemblies, sections, shifts, or shops.

2. The general size of the premiums for the fulfillment and overfulfillment of the production plan and improvement of quality indicators is established on the basis of the extent of the influence of individual groups and occupations of the workers on the increase

in the production and improvement of the quality of the products in the following ranges:

A) In manufacture of basic nitric acid and organic chemistry, in the manufacture of schistose chemicals, hydrolysis, varnishes and paints, exygeneous, thermosetting mass and its products, chemico-pharmaceutical, aniline semi-finished products and dyes, polygraphic inks, synthetic alcohol and synthetic rubber, lamp black and re-generators:

for equipment operators of all categories, engaged in apparatus processes, -- up to 30% of the wage rate;

for workers engaged directly at plant units and sections for the preparation (including transport) of raw materials, supplies, semi-finished products, etc. -- up to 25% of the wage rate.

B) In the manufacture of tires, rubber and technical rubber products:

for workers engaged directly at plant units and sections for the preparation of rubber mixtures, calendering, preparation of unvulcanized inner tubes for automobile tires, bicycle tires, vulcanization and assembly of automobile tires, assembly and gluing of rubber footwear, and technical rubber articles on conveyors and work tables, die punching of footwear, vulcanization, moulding and unloading of cooked inner tubes, impregnation of fabrics -- up to 30% of the wage rate;

for workers engaged at plant units and sections for the preparation (including transport) of raw materials, supplies, intermediate products, parts, -- up to 25% of the wage rate;

C) In the manufacture of technical asbestos products: for workers engaged directly at plant units and sections of spinning, weaving, pressing, calendering, vulcanization, impregnation, paper machines -- up to 30% of the wage rate;

for workers engaged in the preparation (including transport) of raw materials, supplies, intermediate products, parts, -- up to 25% of the wage rate;

D) In the manufacture of artificial and synthetic fibers:

for assistant foremen operating spinning machines for viscous, synthetic and acetate silk, cellophane machines, staple fiber mill units for various products, -- up to 30% of the wage rate;

for workers engaged directly in the operation of spinning machines for viscous, synthetic and acetate silk, cellophane machines, staple fiber mill units for various products, -- up to 25% of the wage rate;

for assistant foremen operating continuous process machines for cord fibre manufacture, twisting, winding, reeling machines and weaving looms, for the fulfillment of technically-substantiated monthly production norms or production (goal) for acceptable products of the section -- in the amount of 12% and for each one per cent of overfulfillment -- 3% of the wage rate; the maximum amount of the premium payments shall not exceed 30% of the wage rate;

for workers operating directly continuous-process machines for cord fibers (twisters, finishers, spinner-dryers) and textile machines (spinners, reelers, winders, senior strippers and twist mill strippers, weavers), for fulfillment of monthly production norms for acceptable products from 100 to 101% -- in the amount of 6% and for each additional percent of overfulfillment of norms, 2% of the wage rate; the maximum amount of the premium payments shall not exceed 25% of the wage rate.

Workers of individual production sections not listed in sub-paragraphs "a", "b", "c" and "d" who directly affect the fulfillment of the plan and improvement of the quality indicators may be awarded premiums up to 15% of the wage rate.

3. Equipment operators in production shops of enterprises for the manufacture of synthetic vitamins, aromatic substances and fatty acids, photochemical plants, wood-chemical factories, and in the manufacture of artificial leather (substitutes for upper parts in shoe manufacture) are paid premiums for improvement of the quality indicators and saving of raw materials and supplies on condition of fulfillment of the production plan in the amount of 20% of the wage rate; workers of other occupations of the individual production sections having a direct influence on the improvement of the quality indicators and saving of raw materials may be awarded premiums in the amount of up to 10% of the wage rate.

4. Workers engaged in underground and open pit mining (including mining industry and industrial exploration) for the output and concentration of mined chemical raw materials are given premiums for the fulfillment and overfulfillment of the monthly quota by the plant unit, section, shift, shop, in the following amounts:

a) on underground mining:

for workers engaged directly in site preparation work, in drifting of advance and capital mining workings;

for fulfillment of the plan -- up to 20%, and for each one percent of overfulfillment of the plan -- 2% of the piece wages;

workers engaged in the transportation of ore and rock from mines or ore slides to lifts to the surface, in working of the ore slides and proportioning machinery, in hauling lumber, boarding and repair of haulage roads, for fulfillment of the plan -- up to 15%, and for each percent of overfulfillment of the plan -- 1.5% of the piece wages;

b) in open-pit mining and general work on the mine surface:

for workers engaged directly in stripping and mining: drill rig operators and their assistants; clamshell excavator, dump tractor, hydraulic-excavator operators and their assistants; drifters, drillers, miners, bulldozer machinists (tractor operators), tractor-drawn scrapers, scraper operators, drivers of dump trucks for hauling ore and rocks, for the fulfillment of the plan -- up to 20% and for each percent of overfulfillment of the plan -- 2% of the piece wages;

for workers engaged in operating cage, skip and winch hoists, hanging-on and haulage preparation, trucking and lowering into the mine shaft of bribbing and shoring materials; for workers engaged in mining of non-metallic and wall-up materials; dump piles and their maintenance, for the fulfillment of the plan -- up to 15% and for each percent of overfulfillment of the plan -- 1.5% of the piece wages;

c) at concentrators:

for workers operating directly rock crushers, pulverizers, flotation mills, drying machines and equipment; operators of potassium ores, carnallite and apatite concentrators; autoclave operators in sulfur smelting; burners of arsenic and diatom; workers engaged in operation of washers and separators; workers engaged in operation of concentration tables and sluices, for fulfillment of the plan -- up to 20% and for each percent of overfulfillment of the plan -- 2% of the piece wages;

for workers engaged in preparation of and proportioning of ore; workers engaged in the transporting of equipment, washing assemblies, reagent feeders, salt plant operators, for fulfillment of the plan -- up to 15%, and for each percent of overfulfillment of the plan -- 1.5% of the piece wages;

Other workers, engaged in underground and open mine work for the output and concentration of battery ore and raw materials and on the mine surface, may be given premiums for the fulfillment of the plan up to 10% and for each percent of overfulfillment of the plan -- 1% of the piece wages.

The amount of premium payment for the overfulfillment of the plan for workers engaged in underground and open mining work, at the mine surface and at concentrating plants, must not exceed the amount of premium established for the fulfillment of the plan.

5. Piece wage workers engaged in repair of major technological equipment directly in the main production (experimental) shops are awarded premiums for high-quality fulfillment of repair work in time or ahead of schedule, on the condition that the production plan of the respective plant units, sections or shops at enterprises listed in the second and fourth sub-paragraphs of these rules and regulations will be met, such premiums amounting to up to 20% and at other enterprises of the chemical industry up to 10% of the wage rate.

6. Premiums are paid to piece-wage workers on condition of fulfillment by them of the average production norms for the month.

7. For the purpose of computing the premium payments for a plant unit, section, shift or shop, the percentage of the fulfillment of the plan is determined from the acceptable production output of established quality included in the fulfillment of the plan.

For the computation of premium payments, cost accounting data is used as a basis. Premium payments for the fulfillment and overfulfillment of the production plan are made as follows:

to workers operating plant units or production sections -- according to the results of the performance of the plant unit or section;

to workers engaged at several plant units or an entire shop, -- according to the performance results of the plant units or the shop;

to workers servicing a shift in the presence of plan or accounting indicators for the shift -- in accordance with the performance results of the shift;

8. Payment of premiums for economy of raw materials and supplies may be made on the basis of norms approved by senior organizations.

9. The total amount of premium payments made to workers for economy of raw materials and supplies must not exceed 40% of the amount saved.

9. Premiums are approved by the head of the shop, mine, quarry, factory or plant, or by the person in charge of the enterprise, upon recommendation of the foreman, senior foreman or other official.

The head of the shop, mine, quarry, factory or plant, or person in charge of the enterprise, has the right to deprive individual workers of the entire premium payment or to decrease the amount of the payment for the worker's negligence at work, as well as for absenteeism.

The deprivation of a worker of a premium payment or the decrease of its amount is done only for that pay-roll period during which the negligence in the work or the absenteeism took place.

The deprivation of individual workers or the decrease in the amount of their premium payment is made public by order or instructions to the shop, mine, quarry, plant or enterprise, stating the reasons for such action.

10. The premium is included in the wages of the monthly pay-roll.

11. To workers who have not worked a complete month because of being called in for military services, transferred to another job, enrolled in a school, retiring on a pension, laid off due to staff reduction, and for other valid reasons, premium payments are made on the basis of the time actually put in by them during the given month.

12. Premiums to workers for the fulfillment and overfulfillment of the plan, as well as for quality indicators, are paid out of the wage fund.

The system of premium payments must be worked out in such a manner that its application would not cause any over-expenditures of the wage funds or increase the cost of production.

13. On the basis of the accepted practice, rules and regulations are worked out and approved by the directors of enterprises, in agreement with the trade-union committee, regarding piece-wage premium payments for workers, which regulations provide for premium factors and conditions under which the premiums are made, scale of premium payments as well as the occupations of the workers receiving premium payments.

The period for which the rules and regulations are in effect is established in each individual instance, based on production requirements.

14. A two-weeks' notice regarding any cancellation or modification of the premium payments system regulations is given to the workers of the plant.

#### Procedure for the Development of the Rules and Regulations of Workers' Premium Payments

In developing the rules and regulations governing premium payments, definite premium factors are established depending on some specific problems which have to be resolved within a given production section.

In sections where increase of the production volume is a decisive factor, and collective (brigade) fulfillment of job assignments is the basic form of work scheduling, it is most rational to make the payment of premiums to workers for the fulfillment and over-fulfillment of production plans by the brigade, plant unit or section (on condition that the quality indicators are maintained).

In production sections where the decisive significance in the fulfillment of the plan is that of increase in labor productivity through better use of equipment and working time, premium payments may be made for the over-fulfillment of technically-substantiated production norms.

In production sections where the decisive role is played by improvement in the use of raw materials and supplies, raising of production quality, decrease in losses (rejects), etc., it is rational to apply a system of premium payments for the fulfillment and overfulfillment of the respective quality indicators on condition of fulfillment of production norms and production plans or assignments.

In production sections where simultaneously with an increase in production volume it is necessary to ensure also a rise of the quality indicators, premium payments to workers may be made for the fulfillment and overfulfillment of production plans and for the achievement of definite quality indicators.

The basis for the establishment of premium factors must be the following:

- 1) Plans and production assignments for the plant unit, section and shop;
- 2) Technically-substantiated production norms;
- 3) Substantiated operating consumption rates of fuel, electric power, raw materials and supplies;

- 4) Planned quality programs;
- 5) Equipment shut-down norms for repairs, etc.

For the determination of the range of workers being paid premiums by individual departments, shops and sections, it is necessary to act on the basis of the extent of influence of individual groups and occupations of workers upon the increase in production and the raising of production quality.

The range of piece-rate workers being paid premiums must be restricted. Payment of premiums must be introduced for piece-wage workers of production shops directly participating in the technological production process and having a direct influence on the increase in production output, improving the quality and lowering the cost of production.

Rules and regulations governing the payment of premiums must provide for:

- 1) indicators (factors) for payment of premiums;
- 2) conditions for premium payments;
- 3) amount of premiums;
- 4) workers' occupations subject to premium payments or a list of production sections;
- 5) pay-roll period for which the premium is being paid;
- 6) the right of the persons in charge of enterprises to deprive workers of the premium in full or in part for negligence in their work and absenteeism;
- 7) method of computation of premiums and dates of payments;
- 8) financial sources for the payment of premiums;
- 9) periods of validity of the rules and regulations governing payment of premiums;
- 10) the method for the introduction of the premium rules and regulations, the method of their modifications, or the method for cancellation or termination of their effectiveness.

The payment of premiums is, as a rule, made according to the results of work performed during one month, with the exception of

those cases where a longer or shorter period of time is required for the performance of the work.

Premiums are computed for time actually worked.

In the computation of a premium for the fulfillment and over-fulfillment of production norms the following time is excluded from the calendar work time:

- 1) regular or extra vacation time;
- 2) sickness;
- 3) the performance of state or public duties;
- 4) planned preventive repair and maintenance;
- 5) leaves of absence granted for breast-feeding of infants;
- 6) shift-long idle time not caused by the worker;
- 7) the withdrawal or transfer of workers for a full shift period to other assignments which are not subject to premium payment under the rules and regulations currently in effect;
- 8) business trips;
- 9) time-off given to workers for working without reduction of the work hours on the day preceding a day-off or preceding a holiday;
- 10) time by which days preceding days-off and preceding holidays are shortened.

The time worked over and in excess of that established by the calendar or schedule (overtime), is added to the calendar time while the work performed during that time is included into the output performed during the given month.

The payment of premiums to workers for quantity work indicators, as well as for improving the quality of the product, is made from the wage fund, and the premium is paid irrespective of the status of the wage-fund expenditures by the section, shop or enterprise.

The amounts of the premiums and the number of workers subject to premium payments must be confirmed by economic considerations in order to avoid a relative over-expenditure of the wage fund and increase in the cost of production of the given enterprise in the introduction of a premium payment for piece-wage workers or hourly-wage workers.

As an example, the indicators and amounts of premiums for workers of separate manufactures at enterprises of the chemical industry are adduced below.

Indicators and Amounts of Premium Awards (in % of the Wage Rate) for Workers of Different Manufactures

| Occupation | Indicators              |                               | For quality indicators |
|------------|-------------------------|-------------------------------|------------------------|
|            | For fulfillment of plan | % of over-fulfillment of plan |                        |
|            |                         |                               |                        |

Manufacture of Sulfuric Acid

(Voskresenskiy chemical kombinat).

|                            |    |   |  |
|----------------------------|----|---|--|
| Furnace attendants         | 25 | 3 | For lowering the amount of sulfur in the surplus coke, for every 0.1% of decrease 30 rub. is paid to the senior furnace attendant and 18 rub. to the assistant attendant.                                    |
| Lower and upper attendants | 20 | 3 | For saving in nitric acid as against planned norms, 1.5 kop. is paid per kilogram.   |
| Precipitator attendant     | 15 | 2 | In the presence of dust in the gas at the exhaust side of the electric separator in excess of 0.2 gram per one cubic meter, the premium for fulfillment and overfulfillment of the plan is decreased by 50%. |

Maintenance  
and repair  
personnel 5 2 For quality repair of the equipment a premium of 10% is paid

Manufacture of Superphosphate  
(Voskresenskiy chemical kombinat)

Brewer,  
unloader,  
scraper 15 2 For observance of expenditure norms for sulfuric acid the brewer is paid a premium of 10%

Pan mixer  
operator 5 2 --

Tire manufacture  
(Omsk Tire Plant)

Thermoplastic  
process ope-  
rator 10 - With a single breach of the technology of thermoplastic process during one month the premium is reduced up to 50%, with two such acts no premium is paid.

Cord calendar  
operator 30 - When exceeding the established limits of tolerances the premium is reduced 50%.

Hourly and Hourly-Premium Wages

Simultaneously with piece-rate wages for workers, hourly wages are also paid at enterprises. Workers on the hourly basis are paid by the hour or day wage rate of their respective category, according to the number of hours or days actually worked, irrespective of the volume of work performed.

Inasmuch as with this system the work performed by an individual worker is not taken into account, and in fact the work performed has no effect on the wages, no stimulus is created for any improvement of results of the work. Therefore, pay-by-the-hour

wages are applied only in those sections where it is impossible to standardize and calculate the actual labor involved. (The work of electricians, machinists, etc.)

At the same time in the chemical industry, a considerable number of workers paid by the hour (stand-by and maintenance metal workers, electricians) perform responsible work, upon the quality of which depends the continuity of some basic, in many cases continuous production. In order to stimulate work, it is advisable to introduce additional premiums for improvement of quality indicators, for decrease in the number of hours of equipment shut-down as against that which was planned originally, for improvement in the quality of repair work, for economy in electric power, steam, etc.

Thus, for example, maintenance workers servicing the equipment of the main shops may be paid premiums for high quality of repair work and equipment maintenance (absence of unscheduled idle periods, fulfillment of projected preventive maintenance according to schedule.)

Workers servicing power installations, power distribution plants and lines, (stokers, machinists, compressor attendants, electricians on duty), may be paid premiums according to the following indicators:

- 1) saving in consumption of electric power and steam as against the scheduled expenditure norms per unit of production;
- 2) saving in excess of the plan in high-grade fuel by the use of low-grade fuel;
- 3) absence of break-downs and interruptions in the function of equipment.

The hourly-wage system has important advantages as against a straight hourly-wage system, since with the former the workers' earnings depend not only on the number of the hours worked and his qualification, but also on the degree of the corresponding production indicators.

At those enterprises of the chemical industry where strictly regulated technological conditions dominate, and the duties of the operators serving these processes are reduced mainly to the task of watching the functioning of apparatuses and process instrumentation, as well as the maintenance of definite parameters of the technological condition, the application of the piece-rate wage system becomes unadvisable. With a strict adherence of established parameters of the technological regime and with normal routine conditions of production, the volume of production does not have any significant deviations; the production (output) under such conditions cannot serve as basis for the wages of equipment operators. The most important factor in the work of operators related to the processes with

strictly-regulated operational conditions is the observance of established parameters of the technological conditions. In 1959, at the time of the revision of the wages and salaries at enterprises of the chemical industry, many persons in charge of these enterprises rejected the further application of the piece-rate wage system for equipment operators engaged in processes with strictly-regulated technological regimes. Equipment operators in such manufactures were transferred to the time and premium wage system. In accordance with accepted rules and regulations concerning the time and premium wage system at enterprises of the chemical industry (see page 149), equipment operators working with apparatus processes under strictly-regulated conditions may be paid premiums for the fulfillment and overfulfillment of a monthly production plan (assignment) for the plant units, section, shift or shop, as well as for economy in raw materials and supplies as against expenditure norms, for adherence to schedules and technological regimes -- to the extent of up to 30% of the wage rate, and at enterprises of the pulp and paper, photochemical, synthetic-vitamin and aromatic-substance industries, and in the manufacture of synthetic leather -- up to 20% of the wage rate.

The accepted rules and regulations allow the heads of enterprises widespread application of the hourly and hourly premium system of wages, since all workers who directly influence the fulfillment of a plan and improvement of the quality indicators are subject to premium payment.

The problem is that for each occupation depending on its influence on the improvement of the labor indicators specific rules and regulations should be established with regard to premium payments; these rules and regulations should provide for the fact that the earnings of an hourly-rate worker depend not only on his qualification and amount of time worked in the manufacture of the product, but also on the factors of his personal performance.

#### Standard Rules and Regulations on the Hourly and Hourly Premium System of Wages for Workers at Enterprises of the Chemical Industry:

([Note]. (Approved by the Decree of the Gosudarstvennyy Komitet Soveta Ministrov SSSR po voprosam truda i zarabotnoy platy i VTsSPSS -- State Committee of the Council of Ministers of the USSR on problems of labor and wages and the All-Union Central Council of Trade Unions of 3 September 1958, No. 829)

Production workers on the time-rate system in the main shops supervising chemical apparatus processes under strictly-regulated technological conditions are paid premiums for the fulfillment and overfulfillment of the monthly assignment by the plant unit, section, shift, or shop, as well as for quality indicators on condition of

fulfillment of the plan by the plant units, sections, shifts or shops in which they are engaged.

Workers on the hourly wage system in auxiliary shops and auxiliary sections of the main shops are paid premiums for the fulfillment of quality indicators, on condition of fulfillment of the monthly plan by the plant units, sections, shifts, or shops in which they work, or by the enterprise as a whole.

For workers on the hourly wage system the following premium indicators and premium range are established:

| Workers' occupations<br>(types of work)  | Premium indicators  | Amount of premium in<br>% of the wage rate                                       |  |
|--|---|--|--|
|  |   | At plants of the chemical industry<br>(except those indicated in the last graph) | At plants for pulp and paper, photomechanical, synthetic-vitamin and aromatic-substance, fatty-acid, artificial leather (upper leather substitute) manufacture |
| Equipment operators of all classifications engaged in apparatus processes with strictly-regulated regimes in the main shops; assistant foremen of finishing plant units for viscous silk | Fulfillment and overfulfillment of the monthly production plan (assignment), quality indicators, saving on raw materials and supplies as against expenditure norms, increase of production over and above the plan for high-class products, adaptation of new | up to 30   | up to 20   |

|   |  |          |          |
|---|--|----------|----------|
|   | types of raw materials and supplies, adherence to production schedules and technological conditions. |          |          |
| Workers directly engaged in operating plant units for finishing of viscous and caprone silk                                 | As above   | up to 25 |          |
| Blasters, fuse setters, explosive carriers, cartrigers in mining work   | Fulfillment of the plan by section, shift, mine, as well as for quality indicators                   | up to 25 | --       |
| Workers engaged in plant units and sections for the preparation of raw materials, supplies, intermediates, furnace charging | Fulfillment of the plan and uninterrupted operation of production units and sections                 | up to 25 | up to 15 |
| Workers engaged directly on repairs of the process equipment in the main production shops                                   | Accurate completion of repair work within prescribed time limits                                     | up to 30 | up to 20 |
| Workers engaged in repairs of equipment, machinery, control devices, and process instrumentation                            | Accurate completion of repair work within prescribed time limits                                     | up to 25 | up to 20 |

|   |  |          |          |
|---|--|----------|----------|
| Electrical workers on duty at the substations and high-voltage power lines  | Timely and competent completion of work without shut-downs or break-downs of the machinery and equipment   | up to 25 | up to 20 |
| Workers operating compressor, pump, oxygen, air blowers, steam and power, gas, diesel installations, pneumatic air installations, ventilators | Uninterrupted servicing of production sections with water, steam, electric power, gas, oxygen, air, on condition of trouble-free operation with maintenance of equipment in proper working condition | up to 20 | up to 15 |
| Metal workers and electricians on duty  | Timely and expert performance of work without shut-down or break-downs of equipment caused through any fault of such workers   | up to 20 | up to 15 |
| Workers at plant laboratory units   | High quality performance of work in prescribed time periods and maintenance of the technological regime  | up to 20 | up to 15 |
| Laboratory assistants of research, control and analytical laboratories  | Qualitative and timely execution of analyses   | up to 20 | up to 15 |

|   |  |          |          |
|---|--|----------|----------|
| Crane operators and assistant crane operators, operators of excavators, bulldozers, ball mills, steam shovels | Continuous servicing of the production sections on condition of trouble-free operation               | up to 20 | up to 15 |
| Quality control inspectors, product examiners, sample takers  | Absence of rejected articles in products ready for next process operation or in finished products    | up to 15 | up to 10 |
| Workers engaged in transporting of materials, intermediates, finished products and production wastes          | Uninterrupted delivery and removal of supplies, intermediates, finished product and production waste |          |          |
|   | a) with simultaneous performance of loading and unloading operations                                 | up to 25 | up to 20 |
|   | b) without loading and unloading operations  | up to 20 | up to 15 |

Individual workers on the hourly-wage system who have direct influence on the fulfillment of the plan and improvement of quality indicators, but not listed in the present rules and regulations, may be paid premiums in amounts applicable to the corresponding

occupations provided for in the rules and regulations.

Workers on the hourly-wage system in pilot plants, shops and installations who participate directly in the basic technological processes are paid premiums for the fulfillment of the plan or schedule in the adaptation of new types of production and of more advanced technology to the extent of 40% of the wage rate, and in production of synthetic vitamins, aromatic substances and fatty acids, pulp and paper, photochemical, and artificial-leather manufacture -- in the amount of up to 30% of the wage rate.

Repair and other workers on the hourly-wage system at pilot plants, shops and installations are paid premiums on the basis of general rules.

In each production section where premium payments are introduced for workers on the hourly-wage system, observance in the fulfillment of premium factors must be assured.

A premium is computed on the basis of monthly results of labor for time actually worked.

#### 4. Deficiencies in Wage and Salary Organization and Measures for their Elimination

In the decisions of the July (1955) Plenary Session of the TsK KPSS and of the XXth Party conference, some serious deficiencies were revealed in the wage and salary organization at industrial enterprises.

In the report of the TsK KPSS to the XXth Party conference it was pointed out "that there are many irregularities and much confusion in wage and salary systems and in scale-rating. The Ministries, departments and trade unions have not paid enough attention to these problems and have allowed them to become quite neglected. We are confronted with the important political and economic problem of bringing the proper order into the wage system.

"It is necessary persistently to improve and perfect wage forms in all branches of the economy, to place wages in direct dependence on the quantity and quality of each worker's labor and to utilize fully the powerful lever of material interest for the purpose of raising labor productivity."

Deficiencies in wage and salary organization were present in enterprises of the chemical industry also. They were the result of the fact that for a long period of time no important changes were made in the wage-scale system, in spite of the progress in production engineering and of systematic increases in wages. Since the time of establishment of the present wage scale system, the average earnings of workers has been more than doubled, whereas the level of the wage rates has remained unchanged. As a result, the specific ratio of the wage rate in the average earnings of workers has fallen by as much as 50%.

Such a discrepancy between the wage rate and the level of the planned average workers' earnings was causing the application of ineffective wage systems for encouraging performance, artificial raising of wage rates, to the establishment of reduced production norms. The production norms were not being technically substantiated; they were calculated on the basis of the production plan, instead of being established on the basis of careful and detailed verification of the production capacities of a plant unit, taking into consideration the latest developments in technique, perfection of production technology and introduction of most rational forms of work scheduling.

The production norms, moreover, were as a rule established 15-20% below those necessary for assurance of the production output. For example, at the Voskresenskiy Chemical Plant the production norm for the manufacture of sulfuric acid was established 15% below the production plan, for superphosphate 12-13%, for sulfocarbon 10-12%.

At the Vinnitskiy Superphosphate Plant the discrepancy between the production norm and the plan reached as much as 16%, at the Slavyanskiy Soda Plant the shift production norm for chlorpicrin was 30% below the plan, at the Kemerovskiy Karbolit Plant, with the projected plan for pressing 90 storage cells per shift the norm of 70 cells was established, etc.

All this led to the fact that even considerable overfulfillment of production norms by workers did not always assure the production plan of the enterprise. At the Aktyubinskiy chemical kombinat, for example, the current production norms in sulfuric acid manufacture in 1955 were fulfilled to 118%, whereas the production plan for sulfuric acid was not being fulfilled.

Such practice of establishing norms seriously hindered any growth of labor productivity. At the same time, the discrepancy between the wage rates and the average wages had an adverse effect not only on the establishment of technical norms, but also on wage organization. Some arbitrarily invented systems of premium payments for incentive purposes were being applied at some plants to individual workers that were based on four or five factors.

For example, at the M. I. Kalinin chemical plant workers engaged in unloading a product were paid premiums for the fulfillment of the plan, for each percent of overfulfillment of the plan, for the fulfillment of the plan for turning out a first-class product, for each percent of the completion of a first-class product and for the use of heavy packaging.

Such a practice of paying premiums to individual workers on the basis of several factors brought confusion into the computation of wages; workers did not know which factor was decisive at a given enterprise, and upon which one they should concentrate their attention. Moreover, in a number of cases the amount of the premium paid to workers for improvement of the quality indicators considerably exceeded the amount of the economy achieved. Thus, at the Krasnyy Bogatyr' plant in July 1955, 9,652 rubles were paid to the female

workers at one conveyor by way of premium for decreased spoilage of footwear, while the saving to the plant as a result of this decrease of spoilage amounted to only 2,313 rubles.

A serious deficiency in wage organization for workers of the chemical industry was the application of different wage scales. At enterprises of the chemical industry the following seven-category wage scale, with a ratio of 1 : 2.3 between the extreme categories was being applied:

Wage Scale at Basic-Chemistry Enterprises

| Categories     | I   | II   | III  | IV   | V    | VI   | VII  |
|----------------|-----|------|------|------|------|------|------|
| Factors        | 1.0 | 1.12 | 1.23 | 1.46 | 1.64 | 1.94 | 2.33 |
| Disparities, % | -   | 12.0 | 10.0 | 19.0 | 12.4 | 18.3 | 12.0 |

The above wage scale violated the principle of progressive increase of the difference in the wages of workers in transferring from the lowest categories to the highest. Thus, in transferring a worker from work in the third category to work in the fifth category, his scale rate was increased by 19%, and in transferring from the fourth to the fifth category it was increased by only 12.4%, etc.

A still more unsatisfactory wage scale was being applied at enterprises of the rubber industry:

Wage Scale at Rubber Plants

| Categories     | I   | II   | III  | IV   | V    | VI   | VII  | VIII | IX   | X    |
|----------------|-----|------|------|------|------|------|------|------|------|------|
| Factors        | 1.0 | 1.05 | 1.13 | 1.22 | 1.34 | 1.44 | 1.52 | 1.77 | 1.97 | 2.15 |
| Disparities, % | -   | 5.0  | 6.0  | 8.0  | 9.9  | 8.0  | 5.6  | 16.5 | 11.3 | 9.2  |

Here in transferring a worker from the fourth to the fifth category his wage rate was increased by 9.9%, and from the sixth to the seventh category -- by only 5.6%; in transferring from the seventh to the eighth category -- by 16.5%, and from the ninth to the tenth category -- by only 9.2%.

In the artificial fiber manufacture a twelve-category scale was in use, with a ratio of 1: 2.7 between the extreme categories:

Wage Scale at Artificial Fiber Factories

| Categories   | I   | II   | III  | IV   | V    | VI   | VII  | VIII | IX   | X    | XI  | XII  |
|--------------|-----|------|------|------|------|------|------|------|------|------|-----|------|
| Factors      | 1.0 | 1.09 | 1.20 | 1.32 | 1.44 | 1.58 | 1.73 | 1.90 | 2.08 | 2.29 | 2.5 | 2.7  |
| Disparities, | -   | 9.0  | 11.0 | 10.0 | 9.1  | 9.8  | 9.5  | 10.0 | 9.5  | 10.0 | 9.0 | 10.0 |

This wage scale possesses the same deficiencies as the two preceding ones.

Violation of the principle of progressive increase of the difference in the wages of workers being transferred from a lower to a higher category lowers the workers' interest in raising their qualifications, and this in the long run has an adverse effect on the quality of performance of technological processes.

A number of serious deficiencies were revealed at enterprises of the chemical industry, the job classification manuals of which had not been revised since 1947. The senior departments of the former Ministry of the Chemical Industry developed such manuals themselves for all the production branches subordinate to them, without coordination with the manuals for the production of other senior departments. As a result, in the manufacture of sulfuric acid, for example, there were six job classification manuals, in the manufacture of chlor and calcium hypochlorite -- seven, and in the production of hydrochloric acid -- five.

This led to a situation where in one and the same manufacture, which had previously been under the jurisdiction of different administrations, the same occupations had different names, and were assigned different categories. Thus, a worker engaged in the process of burning pyrites in sulfuric-acid manufacture, according to the manual of the aniline industry was referred to as pecheyoy (baker), and according to the manual of basic chemistry -- Pechnik (furnace man). Tower operators at enterprises within the system of the Glavkhimprom (Main Administration of the Chemical Industry) were classified in the fifth category, and at enterprises of nitric acid manufacture -- in the seventh category. Filter operators engaged in sodium nitrate and sodium sulfate manufacture at various enterprises were classified in

the fourth and fifth categories.

The manuals provided for excessive division of workers' occupations, not justified by actual requirements. For example, hundreds of various qualification characteristics were established for the occupation of "operator". At the same time, for many new products which had appeared in recent years there were no approved job classification manuals, and workers at such establishments were classified at the discretion of the management.

In accordance with the decisions of the XXth convention of the KPSS, the State Committee of the Council of Ministers of the USSR for problems of labor and wages, with the participation of the Ministry of the Chemical Industry and TsK of the trade union of workers of the petroleum and chemical industry in 1958 worked out basic measures for regulating the standardization of labor and wages of workers at enterprises of the chemical industry, which measures were approved by the TsK KPSS and by the Council of Ministers of the USSR.

The regulating of workers' wages was directed toward an assurance of further increases in the rates of low- and average-wages for workers; decrease in disparity between workers' wages in the low- and average-wage groups on the one hand, and the highly-paid groups on the other; increase in the specific value of the wage scale; widespread adoption of technically-substantiated production norms. All of these measures were aimed toward the achievement of a further increase in labor productivity and lowering of production cost.

In accordance with the Decree of the TsK KPSS and Council of Ministers of the USSR, at all enterprises of the chemical industry a new single seven-category rate scale was introduced in 1958-1959, with a ratio of 1 : 2.3 between the extreme categories. The ratio between the categories in the rate scale is 14-15%, which creates an interest on the part of the workers in the increase in their qualifications. New, higher wage rates have been introduced, which assure bringing the specific value of the wage scale in the average wage for workers on the piece wage system to 70-75%, and in the earnings of workers on the hourly rate system -- to 75-80%. The payment of premiums, approved by the State Committee of the Council of Ministers of the USSR on problems of labor and wages and the VTsSPS, was regulated. New job classification manuals which satisfy the requirements of the present day level of development of the chemical production have been compiled.

For productions encountered at many enterprises (for example, the manufacture of acids: sulfuric, salt, phosphorous, acetic, etc.), a single manual for workers' occupations in continuous chemical productions has been compiled. Thereby deficiencies in the classification of workers and various designations for identical occupations have been eliminated, which had existed in previously effective manuals.

With the introduction of new wage administration the structure of the workers' wage fund was essentially changed, and the share of the tariff scale in the wage was increased. Additional payments for the overfulfillment of the production norms, which were previously made with the progressive piece wage system, at present hardly take place. Regulation of the standardization of labor has brought about a decrease in additional wage payments for overfulfillment of production norms (Table 19).

Table 19

Changes in the Structure of the Workers' Wage Fund (in %)  
at Individual Enterprises of the Chemical Industry

([Note]: S. Z. Pogostin -- An Experiment in  
Regulation of Workers' Wages at  
Enterprises of the Chemical Industry,  
Profizdat, 1958, page 28).

| Indicators   | Voskresenskiy Kombinat | Stalino-gorskiy Kombinat | Kineshemska Plant | Kuskovskiy Plant |
|--|------------------------|--------------------------|-------------------|------------------|
| Scale  | Before regulating      | 55.4                     | 63.3              | 57.2             |
|  | After regulating       | 77.4                     | 79.2              | 74.5             |
| Supplementary Earnings for Overfulfillment of Production Norms | Before regulating      | 17.5                     | 18.1              | 22.1             |
|  | After regulating       | 17.6                     | 5.5               | 9.5              |
|  |                        |                          |                   | 6.7              |

|                                |                   |      |      |     |      |
|--------------------------------|-------------------|------|------|-----|------|
| Progressive Supplementary Pay  | Before regulating | 11.5 | 2.1  | 5.1 | 5.5  |
|                                | After regulating  | 0.2  | 0.5  | 0.5 |      |
| Premium for Quality Indicators | Before regulating | 10.3 | 12.2 | 9.2 | 5.5  |
|                                | After regulating  | 7.8  | 8.6  | 7.4 | 10.8 |
| Other Supplementary Payments   | Before regulating | 5.3  | 4.3  | 6.4 | 7.9  |
|                                | After regulating  | 7.0  | 6.5  | 8.1 | 7.7  |

The introduction of new wage payment administration made it possible to adjust some adequate ratios in the wages of individual groups of workers.

The new wage system made it possible to increase considerably the status of technical standardization and to ensure the growth of labor productivity with a simultaneous increase in the average wages of workers. In order to achieve the Party's goal of a further increase in the wages of low-and average-paid workers and other employees and decrease in the disparity in their wages as compared to the highly-paid groups of workers, the regulating of wages will be continued. By 1965 it is proposed to bring the wages of low-paid workers from 270-350 rub. up to 500-600 rub. a month. This measure will be carried out gradually, in two stages.

The first stage is from 1959 to 1962. During this stage the minimum wage will be increased to 400-450 rub. a month for all branches of the national economy.

The second stage is from 1963 to 1965. During this stage it is proposed to raise the minimum wage for workers and other employees in all branches additionally by 100 to 150 rub. a month, that is, to bring it up from 400-450 rub. to 500-600 rub. a month, with a certain increase in the rates and wages of average-paid workers and other employees.

## 5. Wages and Salaries for Multiple-Equipment Use Operation

At enterprises of the chemical industry, the following wage and salary system is applied for multiple-equipment use operation:

1. Piece-workers operating additionally (or above the established norms) one or several pieces of equipment, or performing additional assignments paid on a piece-rate basis, receive wages for all the work performed (for the entire production output) in accordance with the full piece-wage rates for corresponding work.

Thus, a worker who in accordance with the norm operates a single apparatus, after being assigned to the operation of two apparatuses, if these apparatuses function under normal operating conditions, receives a double wage, and when assigned to operation of three apparatuses without lowering the production efficiency of each apparatus, receives a triple wage, and so forth.

In those cases where the operation of additional equipment or additional assignments are performed not by one, but by several workers (a collective body), the wages for additional performance of the work (production output) is computed for all workers who have performed such work, taking into consideration the participation of each worker.

2. For workers who operate additionally equipment for which different production norms and piece-rates are established, wages are computed on the basis of the production indicators for each individual apparatus separately, on the condition that the production norms for all the apparatuses operated by this worker (brigade) are fulfilled.

The above may be better explained by the following examples.

An example of the calculation of pay for additional operation of an apparatus and with piece-work wages.

The rules and regulations of the wage system for operation of refining rolls have been established as follows:

Number of personnel -- one refiner of the fifth category;

Production norm -- eight tons per single shift at a rate of 4 rub. 30 kop.;

The monthly wage rate for an operator of the fifth category is 880 rub.;

While operating one machine and producing 220 tons, the operator's wage will be:

$$4 \text{ rub. } 30 \text{ kop.} \times 220 = 946 \text{ rub.}$$

The operator has been assigned to the operation of two machines and during a period of 25 days produced 440 tons (the monthly production norm for two machines is  $8 \times 25 \times 2 = 400$  tons.)

The operator's wages will be

$$4 \text{ rub. } 30 \text{ kop.} \times 440 = 1,892 \text{ rub.}$$

An example of the computation of wages for additional performance of piece-rate work.

The rules and regulations for wages for operation of vacuum mixers has been established as follows:

Number of personnel -- one operator of the sixth category and one assistant operator of the fifth category;

Production norm -- 10 tons per single shift, at a rate of 3 rub. 52 kop. for 1 ton of production for the operator; 3 rub. 04 kop. for the assistant operator.

The daily wage rate for an operator of the sixth category (under normal labor conditions) is 35 rub. 24 kop.

The operator has started to perform additionally the duties of an assistant operator, and the actual average-shift output has amounted to 12 tons.

Under such conditions the operator is due to receive on an average per shift:

for his regular work ... 3 rub. 52 kop  $\times$  12 = 42 rub. 24 kop.

for the additional work 3 rub. 04 kop  $\times$  12 = 36 rub. 48 kop.

Total 78 rub. 72 kop.

An example of the computation of wages for performance of additional work with different pay rates.

In accordance with the wage rules and regulations the following is established:

The collective production norm per section is 15 tons per single shift;

The number of personnel -- one operator of the sixth category and one assistant operator of the fifth category;

The rate is as follows:

for the operator

$$35 \text{ rub. } 24 \text{ kop.} : 15 = 2 \text{ rub. } 35 \text{ kop.}$$

for the assistant operator

$$26 \text{ rub. } 52 \text{ kop.} : 15 = 1 \text{ rub. } 77 \text{ kop.}$$

The operator has assumed upon himself the work of the assistant operator, and the actual average-shift output for the section has amounted to 18 tons.

The operator is due to receive, in accordance with the piece-rate wage (on an average per shift):

for his regular work ....  $2 \text{ rub. } 35 \text{ kop.} \times 18 = 42 \text{ rub. } 30 \text{ kop.}$

for additional duties ...  $1 \text{ rub. } 77 \text{ kop.} \times 18 = 31 \text{ rub. } 86 \text{ kop.}$

Total  $74 \text{ rub. } 16 \text{ kop.}$

In those cases where the relocation of equipment, installation of apparatuses and devices, etc., is required in order to create the necessary conditions for change-over to multiple-equipment operation, with corresponding expenditures, or where additional personnel is required for multiple-equipment operation, production norms and rates must be revised.

## 6. Wages and Salaries in the Case of Overlapping Occupations

When piece-rate workers or hourly-rate workers combine their main occupations with an additional occupation which is subject to an hourly rate, the additional work (in accordance with the accepted practice at enterprises of the chemical industry) is paid at a rate from 25 to 50% of the wage rate of the combined occupation. The additional wage may be paid only in a case when a worker whose functions have been combined has actually been released within the section concerned. Otherwise the combination of occupations will not be effective and any additional pay may cause everexpenditure of the wage fund.

In case of the performance through combination of additional work subject to the hourly-wage system, not by one but by several workers (a collective), the additional pay for the combined work is distributed among all of the workers performing such work.

The above may be clarified by some examples.

An example of the computation of the wage when a piece-rate worker combines the duties of an hourly-rate worker. An equipment operator of the sixth category operating a single apparatus with a production norm of 15 tons per shift assumes additionally the duties of a sample assayer who is paid according to the hourly rate for the fourth category (23 rub. 39 kop. per shift). The average-shift actual output was 16 tons.

The rate per one ton is 2 rub. 35 kop. The daily wage rate for an operator of the sixth category is 35 rub. 24 kop.

The operator's daily wage will be:

for his regular work .... 2 rub. 35 kop.  $\times$  16 = 37 rub. 60 kop.

for the additional duties 23 rub. 39 kop.  $\times$  25 = 5 rub. 85 kop.  
100

Total 43 rub. 45 kop.

An example of the calculation of the wages in the case of combined occupations subject to the hourly-rate wage.

A fifth category metal worker on duty and an oiler of the second category are working in a shop and are paid on the basis of the hourly wage system. The wage rate for the metal worker is 26 rub. 85 kop., and that for the oiler is 17 rub. 90 kop. The metal worker on duty assumes upon himself the functions of the oiler.

The daily wage of the metal worker on duty will in that case be:

for his regular work 26 rub. 85 kop.

for the added duties 17 rub. 90 kop.  $\times$  25 = 4 rub. 47 kop.  
100

Total 31 rub. 32 kop.

## 7. Calculation of Special Types of Wages.

Labor laws have established a procedure for the payment of wages and salaries for workers and other employees for lost time, for overtime and night-time work and for working on holidays, as well as a procedure for the payment of vacation time, etc.

### Payment for Idle Time.

No wages are paid for time lost through any fault of the worker. If, however, the idle time occurred through no fault of the worker, then wages for the lost time are paid at the rate of one half of the wage rate for a worker of a corresponding category on the hourly-rate basis. Lost time occurring because of electric power failure or shortage of raw materials are paid according to the same rule.

During a period of mastering of new production methods, both at new enterprises and those already functioning, wages for idle time not caused by any fault of the worker are paid according to the full wage scale of an hourly-rate worker of a corresponding category. The time allowed for mastering of new production methods (up to three months) is established for each enterprise by the branch administration of the sovnarkhoz in agreement with the trade union organization.

A worker must inform the management immediately of a start of idle time; he must also warn the management in time of any causes that may lead to a loss of time. In cases where a worker fails to perform such duties, no wages are paid for the lost time, and the worker responsible may be penalized. On the other hand, the management must immediately transfer workers who are free because of idle time to other work within the same enterprise. In case of extended idle time (over five days) and impossibility of utilizing a worker in the same enterprise, that worker must be transferred to work at another enterprise in the same locality, for a period not exceeding one month. It is prohibited to transfer qualified workers to the performance of auxiliary work such as delivery, cleaning, moving loads, etc., except in cases where the performance of such work is caused by a major disaster.

When qualified workers of the fifth category and higher, on account of idle time, are transferred to work of a lower category, their wages are paid according to the average rate at their previous work, on condition of fulfillment of norms at the work to which the worker has been temporarily transferred. In case of non-fulfillment of the norms, and also when being transferred to work that is paid for on the basis of an hourly rate, the worker who has been transferred retains the wage rate of an hourly-rate worker of his category at his previous work.

When workers below the fifth category are transferred to other work, of a lower category, as well as when workers of any category are transferred to other work of a higher category, wages are paid according to the rates for the work being performed.

Example. Because of idle time a worker of the sixth category was transferred to work rated according to the fourth cate-

gory, and fulfilled the norm. His wages for that day amounted to 27 rub. 00 kop., whereas his wages according to his previous, regular work, had amounted to 38 rub. 60 kop. In addition to his wages for the work performed, he was due to receive the difference between the wages received and his average wage according to his previous work:

$$38 \text{ rub. } 60 \text{ kop.} - 27 \text{ rub. } 00 \text{ kop.} = 11 \text{ rub. } 60 \text{ kop.}$$

At enterprises of the chemical industry, where, as a rule, a single worker operates several apparatuses, there occur cases of idle time for a part of the equipment being operated due to causes beyond the control of the workers. In such cases the wages for the period of idle time are tabulated in the following manner. The amount of machine-hour of operation is determined in accordance with the hourly-wage rate, and the operator receives additional wages for the period of the idle time of some equipment, in the amount of one half of the amount of the machine-hours of the idle time.

Example. An operator of the sixth category, in accordance with the established norm, operates three apparatuses. One of the apparatuses remained idle for the duration of a shift for four hours, for reasons independent of the operator.

The additional wages for the idle time of the apparatus over the production hourly wage is tabulated in the following manner.

The wage scale for an hourly-rate worker of the sixth category amounts to 31 rub. 09 kop. per shift. The operation norm per shift is  $7 \times 3 = 21$  machine-hours. Wages due for one hour of operation amount to:

$$31 \text{ rub. } 09 \text{ kop.} : 21 = 1 \text{ rub. } 48 \text{ kop.}$$

Therefore, additional wages due for four machine-hours of the idle time amount to

$$\frac{(1 \text{ rub. } 48 \text{ kop.} \times 4) \times 50}{100} = 2 \text{ rub. } 96 \text{ kop.}$$

#### Wage payments for Rejects.

Wage payments are tabulated by different methods, depending on whether or not the rejects are total (product is entirely unusable) or partial (the quality of product fails to meet the established requirements, but it may be reworked into a usable product or marketed as a lower-grade product). Total rejects due to negli-

gence on the part of a worker are not subject to any wage payments whatever, whereas lowered wages are paid for partial rejects. The percentage of suitability of a product and the exact amount of wages is established by the plant management, and wages may not exceed one half of the wage rate for the worker involved.

In case of production rejects through no fault of a worker, wages are tabulated in the following manner.

Wages for total rejects are paid in the amount of two-thirds of the wage rate of an hourly-rate worker of the corresponding category; wages for partial rejects are subject to payment at lowered rates, dependent on the extent of suitability of the product, the percentage of suitability and exact amount of wage being established by the management similarly as in the case of partial rejects through the fault of a worker. Wages in such a case cannot be lower than two-thirds of the wage rate for an hourly-rate worker of a corresponding category. Rejected production caused by inadequate quality of raw materials and supplies and discovered after at least one working day has been spent on its manufacture, is paid for according to normal piece-wage rates. Similarly, for rejects through no fault of a worker, discovered after the product has been accepted by the technical control department, wages are paid to the worker concerned in the same manner as for usable products.

Example. For a cutter of rubber production parts of the fourth category a shift production norm of 420 parts has been established; the time standard for one part is 1 min., and the piece-work rate -- 26 rub. 52 kop.:  $420 = 6.3$  kop. Actually, the worker made 500 parts, of which 20 were found to be defective through the worker's fault and 40 for other reasons.

Under such conditions the worker is due to receive for the acceptable parts:

$$6.3 \text{ kop.} \times 440 = 27 \text{ rub. } 72 \text{ kop.}$$

No wage is paid for the 20 parts rejected due to the worker's fault.

The production of 40 parts with the established time standard of 1 min. for a part should take 40 min., and the hourly wage rate for an hourly-wage worker of the fourth category is 3 rub. 34 kop. His wages for making 40 parts should be:

$$3 \text{ rub. } 34 \text{ kop. } \frac{2}{3} = 2 \text{ rub. } 23 \text{ kop.}$$

where 3 rub. 34 kop. is the hourly wage rate;  $\frac{2}{3}$  is two-thirds of the wage rate.

Thus, the total wages due to the worker amount to:

$$27 \text{ rub. } 72 \text{ kop.} + 2 \text{ rub. } 23 \text{ kop.} = 29 \text{ rub. } 95 \text{ kop.}$$

During the period of mastering or new production methods, wages for rejects not caused by a worker are paid on the basis of the wage rate for an hourly-wage worker of the corresponding category. A worker must immediately inform the management that the product being made by him is imperfect. If a worker has failed to report this, or has continued to perform his work contrary to instructions to stop the production, then no wages are paid for any subsequent rejected production, and deductions for spoiled raw materials and supplies are taken out of the wages of the worker responsible. However, if the management has ordered that the work be continued, then wages for the imperfect products thereafter are paid as for acceptable production.

The worker is financially responsible for spoilage of materials during production:

- 1) For intentional spoilage -- to the extent of five times the loss incurred;
- 2) for spoilage due to carelessness or negligence -- in the extent of the loss incurred, but not exceeding two-thirds of his average monthly earnings.

Amounts which must be deducted from the worker for spoilage of materials are withheld by order of the management from the wages or from any other amounts due to the worker.

Deductions are made at the time of each payment until the total repayment of the entire amount of deduction. Withholdings from each single payment cannot, however, exceed 25% of the entire amount due. If other amounts are also withheld from a worker's wages, then the total amount of all the deductions withheld cannot exceed 50% of all the amounts due.

#### Overtime Work Payments

Any work performed by order of the management of an enterprise by a worker with a standardized working day, who spends additional time over and above the standard time established for him, is considered to be overtime work.

Overtime work is, as a rule, forbidden by Soviet laws, and is permitted only in exceptional cases.

In each individual case overtime work may be performed with the permission of the presidium of the obkom (oblastnoy komitet - district committee) of the trade union. Such permission is granted on the basis of a request on the part of the enterprise and the trade administration of the sovnarkhoz, and of the decision of the trade-union organization of a given enterprise.

In especially urgent (extraordinary) cases (the prevention of public disasters and dangers, clean-up work after major acci-

dents, etc.), the overtime work is allowed with subsequent report to the senior trade-union organs.

Workers possess no right to refuse overtime work when so ordered by the management.

Wages for overtime work are paid in the amount of one-and-a-half for the first two hours, and double for each subsequent hour. Workers on the piece-work basis are paid for overtime work according to the normal rates, with additional payments over and above the actual wage (earnings) according to the amount of goods produced for each of the first two hours 50%, and for each subsequent hour -- 100% of the hourly rate as applicable to an hourly-rate worker of a corresponding category.

Example. A piece-work worker of the sixth category worked 12 hours overtime, which are paid at a one-and-a-half times rate, and 10 hours overtime paid at a double rate; the hourly-wage rate for the sixth category is 4 rub. 44 kop.

The additional wage due to the worker for the first 12 hours overtime should be

$$\frac{4 \text{ rub. } 44 \text{ kop. } \times 50}{100} \quad 12 = 26 \text{ rub. } 64 \text{ kop.}$$

and for the next 10 hours --  $4 \text{ rub. } 44 \text{ kop. } \times 10 = 44 \text{ rub. } 40 \text{ kop.}$ , or a total additional wage to be paid of 26 rub. 64 kop. + 44 rub. 40 kop. = 71 rub. 04 kop.

Overtime work performed by order of the management is subject to wages even in cases where the management has not formally issued the required permission for such work. Time off in lieu of the overtime pay is not permitted.

#### Payment of Wages for Work on Holidays

Besides days-off, non-working days are: 1 January, 1 and 2 May, 7 and 8 November, and 5 December.

On these days it is permitted to perform work at continuous process plants and to carry out repairs and maintenance work required by emergency production conditions, as well as loading and unloading work in connection with the functioning of railway and water transport.

For work on holidays the remuneration is paid at a double rate: in case of piece-work wages -- according to double piece-work rates for amount of production accomplished on such days; in case of an hourly rate -- in the amount of twice the wage rate for each hour of actual work.

### Additional Payments for Night Work

The time of the day from 10 o'clock P.M. till 6 o'clock A.M. is considered as night-time. The law has provided for a shortening of the working time for the night shift by one hour. Therefore, additional wages are paid for night work.

Additional wages for every hour of night work have been established dependent on the length of the working day and the shift changeover, as well as on whether or not it is subject to the hourly or piece-work wage rates.

With the hourly-rate basis, the wages for every hour of night work, with a seven-hour working day, amount to  $7/6$  of the wages for a daylight hour, and with a six-hour day -- to  $6/5$  of a daylight hour.

With piece-work rates, for every hour of night work,  $1/6$  and  $1/5$  of the hourly rate for the category applicable to a given worker is paid for every hour of night work, in accordance with the length of the working day.

In the case of shift work (in particular, in continuous process productions) the length of a night shift equals that of the day shift, and, therefore, with the hourly-rate wages the pay for every hour of night work in such cases amounts to  $7/6$  of the wages for a daylight hour with a seven-hour working day, and to  $6/5$  of the wages for a daylight hour with a six-hour working day. In the case of piece-rate wages, a worker, in addition to his piece-rate wages, is paid for every hour of night work  $1/6$  of the hourly wages with a seven-hour working day, and  $1/5$  of the hourly wage with a six-hour working day.

### The Procedure for the Tabulation of Average Wages

The Soviet labor law provides for cases where an enterprise is obliged to pay a worker his average wage for time during which he has actually not performed any work. The average wage for some particular place of work is retained in the following cases:

- 1) participation in court sessions as member of the people's jury, public experts or witnesses;
- 2) when workers who are members of a jury perform the duties of a people's judge;
- 3) participation, in the capacity of representatives, in conventions, conferences, and meetings of delegates summoned by state, trade-union and cooperative organs;
- 4) participation in conventions, conferences and plenary sessions convened by organizations of the KPSS and VLKSM (Vsesoyuznyy

Leninskiy Kommunisticheskiy Soyuz Molodezhi - Leninist Young Communist League of the Soviet Union), not below the rayonnnyy level;

- 5) business trips;
- 6) participation in the activities of military draft boards.

In the tabulation of the average wage, both the basic wage is taken into consideration and the additional wage which is of a permanent nature (premiums paid in accordance with systems in effect, special additional payments and increments).

The following are not taken into consideration for the tabulation of the average wage:

- 1) any type of additional remuneration that is of the nature of an extraordinary grant, such as: for the fulfillment of individual tasks that are not included in the usual duties of a worker, remuneration of incentive or premium nature granted on some extraordinary occasion, etc.
- 2) incentive or premium pay and other types of additional remuneration, if they, even though not of an extraordinary nature, are, nevertheless paid for a period of time of over three months (premiums to be paid as a result of socialist competition are not included in the average wage);
- 3) remuneration for overtime work, if such work is not of a steady character (overtime work is considered to be steady if for the period of three preceding months over 10 hours of overtime work was performed for every month);
- 4) remuneration for work during non-working days;
- 5) wages for those hours and days during which the worker actually performed no work (during performance of state or civic duties, during idle time, etc.);
- 6) temporary disability allowances;
- 7) payments in connection with business trips and transfers;
- 8) compensation for unused vacation time, for depreciation of tools; for work clothes, etc.

In the payment of an average wage for twelve or more working days the worker's wage for the three preceding calendar months (from

the 1st to the 1st day of the month) are taken into consideration. For the payment of a lesser number of days only the worker's wage for the preceding calendar month is taken into consideration. In neither case are those days or hours in which the worker actually performed no work at the enterprise, or any amounts paid to him for such days and hours, taken into consideration. Thus, the average wage of a worker for a day or an hour is determined by dividing the worker's wage for the days or hours during which he has actually worked during three or one calendar month, by the number of such days or hours.

If a worker is on the hourly-rate system, then the enterprise pays him the full wage established for him for those days and hours for which he is entitled to payment according to his average wage.

If a worker has worked at a given enterprise or institution less than three or one calendar month, his wage for the entire time since the day he commenced working, beginning with which the payment of the average wage must be made, is taken into consideration. Similarly, if in the course of the three or one preceding calendar months a change had taken place in the rate or system of the workers' wages (by reason of any change in the wage rates, wages and salaries or individual rates, change from the hourly rate to the piece-work rate or vice versa, and transfer of a worker to duties compensated by higher or lower wages), then the worker's wage is tabulated for the time from the day of the last change of his wage up to the day from which the payment of his average wage is to be made.

The combined amount of the average wage which is due to be paid to a worker is determined by multiplying the daily or hourly average wage by the number of working days or hours according to the work schedule covering the period of time for which the payment is due.

If during the period for which the worker is being paid in accordance with his average wage, any change has taken place in his wage for fulfillment of his regular work, then no retabulation is made in connection with such changes, except in the cases where base rates or wages of workers paid in accordance with the hourly rate system have been increased. The enterprise is obligated to pay such workers also the difference between the old and the new rates or wages for the time from the day the wages were raised.

In cases where a worker did not actually work throughout the full working period (in cases of dismissal, absenteeism, etc.), workers on the piece-work wage system are paid according to their actual output, and those on the daily or hourly rate system -- according to the number of days or hours during which they have actually worked. Workers on monthly basis are in such cases paid according to their average daily wage for each day worked. With a base monthly-wage system the daily wage is determined by dividing the last month's wage of the worker by the number of work days in that month.

Example. Determine the average wage of a worker on the piece-rate wage who has to be paid for six days, from 3 to 9 September, which he spent at court on jury duty.

In this case the basis should be his wage for the last calendar month (from 1 to 31 August). In August there were 26 work days. For that month the worker was due:

according to piece-work rates ..... 760 rub. 60 kop.

additional sliding-scale payment ... 56 rub. 00 kop.

additional wage for night hours .... 12 rub. 60 kop.

additional wage for overtime work .. 30 rub. 00 kop.

premium from the enterprise fund... 150 rub. 00 kop.

Total 1,009 rub. 20 kop.

The average daily wage is computed on the basis of the amount of 829 rub. 20 kop. (760 rub. 60 kop. + 56 rub. + 12 rub. 60 kop.), because the premium from the enterprise fund and additional payment for overtime work, not being regular wages, are not taken into account.

Thus, the average wage of the above worker will amount to 31 rub. 89 kop. (829 rub. 20 kop. : 26), and for six days he is due to receive 31 rub. 89 kop. x 6 = 191 rub. 34 kop.

#### Vacations.

During the time a worker is on his regular and additional vacation he retains his average wage.

The tabulation of an average wage to be paid for the time of a regular and additional vacation, as well as for payment of compensation for unused vacation time, is made on the basis of the average wage for 12 calendar months preceding the month during which the worker goes on vacation or for which his compensation is paid (from the first to the 1st day of the month). For example, when a worker goes on vacation in April 1959 the tabulation is made on the basis of his wage for the time from 1st April 1958 to 1 April 1959.

Workers having worked at a given enterprise (institution) less than a year are paid on the basis of the average wage for the time from the day he started work at the given enterprise (from the 1st day of the month after he began work).

In such cases for the calculation of the average wage all types of wages are taken into consideration, as well as allowance for temporary disability paid by social security, and the time

for which such allowances are paid are considered as time worked.

In particular, for the calculation of the average wage to be paid for vacation and compensation for unused vacation, the following types of wages and salaries are taken into consideration, regardless of their regular or irregular nature:

- 1) Production premiums for fulfillment and overfulfillment of a plan, saving on fuel, raw materials, etc.;
- 2) Additional pay for overtime work and night work;
- 3) Length-of-service bonus;
- 4) Vacation pay;
- 5) Idle-time pay;
- 6) Pay for performance of state and civic duties, for military leaves, etc.

The following are not taken into consideration for the tabulation of the average wage: payments from sources other than wage fund, payments outside of the current systems of premium payment (for example, from the enterprise fund, premiums according to the results of socialist competition, extraordinary length-of-service awards, pay for past time (prior to the twelve-months' period being accounted for), payment for incidental work not included in the duties of the worker, payments during business trips and transfers, compensation for unused vacations, payments in kind, compensation for wear and tear on tools, etc.

Pay for vacations or compensation for unused vacation time is calculated by dividing the yearly wages by twelve (including also time off without pay); the obtained average monthly wages are divided by 25.6 (average annual number of working days per month), and the obtained average daily wage is multiplied by the number of vacation days. Such a method of calculation is applied independently of any changes in the wage rate that may have taken place in the course of the year.

Example. A worker has to be paid for 12 working days of regular vacation from 10 October 1959.

For the 12 months preceding the vacation, i.e., from 1 October 1958 to 1 October 1959 the following amounts were accrued to him:

|   |                 |
|---|-----------------|
| according to piece-work rates,<br>including additional sliding-scale payments | 8,680 rub.      |
| premiums for saving on raw materials  | 280 rub.        |
| for night work  | 108 rub.        |
| for overtime work   | 126 rub.        |
| for idle time   | 68 rub.         |
| for time spent in performing civic duties                                     | 94 rub.         |
| allowance for temporary disability  | 160 rub.        |
| premium from competition fund   | <u>400 rub.</u> |
| Total   | 9,916 rub.      |

In the above case only 400 rub. (premium from the competition fund) should be excluded from the total amount in determining the average wage for purposes of payment for vacation time. The remaining amount of 9,516 rub. represents the annual wage taken into consideration for payment for vacation time.

The average monthly wage will be  $9,516 : 12 = 793$  rub. In order to calculate the average daily wage, the average monthly wage must be divided by 25.6:

$$793 \text{ rub.} : 25.6 = 30 \text{ rub. } 97 \text{ kop.}$$

Thus, for his vacation time the worker is due to receive:

$$30 \text{ rub. } 97 \text{ kop. } \times 12 = 371 \text{ rub. } 64 \text{ kop.}$$

#### Problems

1) According to the time schedule, an hourly-rate worker of the third category, worked 168 hours during the month of January.

Determine his wages.

2) For a brigade consisting of: senior equipment operator of the sixth category, two equipment operators of the fifth category, and an assistant operator of the fourth category, all operating a plant unit, a production output norm of 14 tons for a single eight-

hour shift was established.

Determine the actual earnings of each worker.

3) A press operator of the fifth category, operating two presses (the output norm being 120 articles each press per single shift), began to operate also a third press. Working three presses, in a month the press operator produced 10,000 articles.

Determine his monthly earnings.

4) According to the rules and regulations on payment of wages the following is established: the required personnel for a single plant unit consist of: one equipment operator of the fifth category, and one assistant equipment operator of the fourth category; output norm - 15 tons per shift. The equipment operator started to work without an assistant and his actual average-shift output was 16.4 tons.

Determine the average daily earnings of the equipment operator.

5) The machinist of the sixth category, while on duty, also combines the duties of a fifth-category electrician on duty.

Determine the daily wages of the machinist.

6) During the month of May, the output of an equipment operator of the fifth category was 260 tons (shift output norm is 10 tons). According to the shift schedule, the equipment operator worked full time on 1 and 2 May, seven night shifts (from midnight until 8 A.M.), 12 hours overtime and stood idle for 5 hours due to an electric power failure.

Tabulate the monthly earnings of the equipment operator.

7) An equipment operator is granted a leave for 24 working days starting 5 July. For the 12 months preceding the leave, he was entitled to the following:

|                                     |            |
|-------------------------------------|------------|
| according to piece-rate wages       | 7,320 rub. |
| premium for saving of raw materials | 340 rub.   |
| for night work                      | 128 rub.   |
| for overtime work                   | 84 rub.    |

|  |            |
|--|------------|
| for idle time                                | 46 rub.    |
| for time while performing social obligations | 104 rub.   |
| for unused vacation time                     | 680 rub.   |
| director's fund premium                      | 300 rub.   |
| length of service extraordinary award        | 1,540 rub. |

Determine the amount due to the equipment operator for his vacation.

## Chapter Six

### Salaries and Wages of Engineering and Technical Personnel at Enterprises of the Chemical Industry

#### 1. Salaries for Positions of Engineering and Technical Personnel.

Engineering and technical personnel are paid by the hour, day, week or month, in accordance with the wage and salary system. Salaries for each employee are established on the basis of the salary-scheme approved by the government for each branch of the industry.

The salary-scheme provides for various levels of salaries dependent on the degree of importance of the enterprise within a given branch of industry, and of the shop within a plant.

Enterprises of the chemical industry are divided as to salary structure into five groups, and shops into four groups. This was necessitated by the great variety of enterprises of the chemical industry and of shops according to character of the technological processes, volume of production output, number of workers, complexity of administration of the production, etc.

For engineering and technical personnel working at enterprises in group I, higher salaries have been established than for those working at enterprises in group II, and in group II -- higher than in group III, and so forth.

Guided by the approved salary structure according to positions, and by the division of shops into groups with regard to wages and salaries, directors of enterprises compile, within program limits, staff personnel schedules according to type of work, which provide for the number of workers for each position and their respective salaries.

The amount of the salary for each worker is established by the administration according to the salary scheme for the respective positions dependent on the following basic factors:

- a) volume of work in the section under the respective worker's charge;
- b) complexity of the technological process;
- c) responsibilities for the work being performed;
- d) number of prerequisites demanded of the employee;
- e) education requirements prerequisite to the position in question.

Salaries are established so that the combined total of salaries of all employees would not exceed the combined total of the average salaries according to the following scheme:

Scheme of Salaried Positions of Administrative, Engineering and Technical Personnel of the Plant Management (Selective)

| Titles of positions  | Position salaries (in rub.) according to enterprise groups |                 |                 |                 |                 |
|--|--|-----------------|-----------------|-----------------|-----------------|
|  | I  | II              | III             | IV              | V               |
| Director   | 2,900-<br>3,300  | 2,500-<br>3,000 | 2,000-<br>2,500 | 1,500-<br>2,000 | 1,200-<br>1,500 |
| Chief mechanic,<br>chief power specialist,<br>chief technologist,<br>head of the central plant<br>laboratory | 1,900-<br>2,500  | 1,700-<br>2,000 | 1,400-<br>1,700 | 1,300-<br>1,400 | -               |
| Heads of departments:<br>planning, labor and wages,<br>supply, equipment                                     | 1,600-<br>1,800  | 1,500-<br>1,600 | 1,300-<br>1,500 | 1,100-<br>1,300 | -               |

Chief engineers of all professions, chief economist 1,050- 1,050- 1,000- 1,000- 1,000-  
1,350 1,350 1,200 1,200 1,200

Engineers of all professions, economist, designer 1,000- 1,000- 900- 900- 900-  
1,200 1,200 1,100 1,100 1,100

Technicians of all trades, senior laboratory assistant 750- 750- 700- 700- 700-  
900 900 850 850 850

Laboratory assistant 600- 600- 600- 600- 600-  
700 700 700 700 700

Scheme of Salaried Positions of Supervisory, Engineering and Technical Personnel of the Plant Shops (Selective)

| Titles of positions   | Position salaries (in rub.)<br>according to shop and section groups |           |           |           |
|---|---|-----------|-----------|-----------|
|   | I   | II        | III       | IV        |
| Shop head   | 1700-2000   | 1500-1700 | 1200-1400 | 1000-1200 |
| Section (department)<br>head of a production<br>shop, shop mechanic<br>and power specialist | 1200-1500   | 1100-1400 | 1000-1300 | -         |
| Shift superintendent,<br>senior foreman   | 1200-1400   | 1100-1350 | 1000-1200 | -         |
| Chief engineers of<br>all professions   | 1050-1350   | 1050-1350 | -         | -         |
| Engineers of all<br>professions,<br>economist, designer,<br>rate setter                     | 1000-1200   | 1000-1200 | 900-1100  | 900-1100  |
| Foreman   | 1100-1200   | 950-1100  | 800- 950  |           |

|                                   |         |         |         |         |
|-----------------------------------|---------|---------|---------|---------|
| Technicians of all trades, senior | 750-900 | 750-900 | 700-850 | 700-850 |
| laboratory assistant              |         |         |         |         |
| Laboratory assistant              | 600-700 | 600-700 | 600-700 | 600-700 |

The salaries of administrative as well as engineering and technical workers of the shops possess advantages in the wages of those engaged directly in production, as well as in work under hazardous and extremely hazardous working conditions. Wages for work under hazardous working conditions are rated 10% higher, and for work under extremely hazardous working conditions - 20% higher than salaries for engineering and technical personnel engaged in occupations under normal working conditions.

## 2. System of Grouping Enterprises According to Salaries of Engineering and Technical Personnel.

Placing enterprises within one group or another is carried out by the sovnarkhoz's: ministries and departments on the basis of factors approved by the State Committee of the Council of Ministers of the USSR for Problems of Labor and Wages, and the VTsSPS. The factors for grouping enterprises of the chemical industry according to salaries for the administrative and technical personnel take into consideration the following: volume of total gross product, number of workers, power capacity of the enterprise, variety of the product, and also the hazardous or dangerous nature of the production. Each of these factors is expressed by a definite grade (in units). For example, the volume of the total gross product with a production plan of over 300 million rub. is evaluated at four units, from 150 to 300 millions rub. -- at three units, from 50 to 150 million rub. -- at two units, and under 50 million rub. -- at one unit. All other factors are evaluated in the same manner. The combination of the factors determines the complexity of the administration of an enterprise, which may be extra complex, complex, less complex and simple.

The distribution of enterprises according to groups is adduced below:

| Types of enterprises                          | Group according to wages | Number of conditional units (grades) |
|---|--------------------------|--------------------------------------|
| Enterprises with extra complex administration | I                        | 14 and more                          |

|  |     |                         |
|--|-----|-------------------------|
| Enterprises with complex administration      | II  | From 11 to 13 inclusive |
| Enterprises with less complex administration | III | From 8 to 10 inclusive  |
| Enterprises with simple administration       | IV  | From 6 to 7 inclusive   |
| As above                                     | V   | Below 6                 |

The combined total of units determines the group of the enterprise. With a number of units of 14 and more an enterprise is placed in the first group, and so on.

Indicators for Placing Enterprises of the Chemical Industry in Groups According to Salaries of Administrative and Engineering Personnel

([Note] Approved by Decree of the State Committee of the Council of Ministers of the USSR on Problems of Labor and Wages and by the VTsSPS of 3 September 1958 No 829.)

Grouping of enterprises according to salaries of employees is done on the basis of the total sum of conditional units (grades).

A. For enterprises of basic, nitrogen, organic chemistry, paper and pulp, hydrolysis, varnishes and paints, oxygen, chemico-pharmaceutical, photochemical, for the manufacture of artificial and synthetic fibers, thermosetting plastics (without manufacture of articles therefrom), polygraphic inks, aniline semi-finished products and dyes, synthetic vitamins, aromatic substances and fatty acids, synthetic alcohol, synthetic rubber, carbon black, regenerators and asbestos technical products.

Total Gross Production

(with the exception of enterprises for the production of motion picture film, photographic plates and photographic paper).

|                                      |            |
|--------------------------------------|------------|
| Over 300 mill. rub.                  | -- 4 units |
| From 150 to 300 mill. rub. inclusive | -- 3 units |

From 50 to 150 mill. rub. inclusive -- 2 units

Up to 50 mill. rub. inclusive --- 1 unit

### Total Gross Production in Crude Form

(for enterprises producing motion picture film  
and photographic plates)

Over 300 mill. lin. m. (for film) ) -- 4 units

Over 300 thou.  $\text{m}^2$  (for photographic plates)

From 100 to 300 mill. lin. m (for film) ) -- 3 Units

From 100 to 300 thou.  $m^2$  (for photographic plates)

From 50 to 100 mill. lin. m (for film)

From 50 to 100 thou. m<sup>2</sup> (for photographic plates) } -- 2 units

Below 50 mill. lin. m (for film)

Below 50 thou.  $\text{m}^2$  (for photographic plates)

Total Gross Production in Crude form

(for photographic-paper production enterprises)

Over 30 mill.  $\text{m}^2$  of photographic paper -4 units

From 20 to 30 mill.  $\text{m}^2$  photographic paper --3 units

From 10 to 20 mill.  $\text{m}^2$  photographic paper --2 units

Below 10 mill.  $\text{m}^2$  photographic paper --1 unit

### Number of workers

Over 2500 --- 4 units

From 1500 to 2500 inclusive -- 3 units

From 800 to 1500 inclusive -- 2 units

Up to 800 inclusive -- 1 unit

Number of Types of Products

(according to basic nomenclature)

Over 15 products -- 4 units

From 10 to 15 products inclusive -- 3 units

From 5 to 10 products inclusive -- 2 units

Up to 5 products inclusive -- 1 unit

Power Consumption

Over 75 mill. kWhr -- 4 units

From 35 to 75 mill. kWhr inclusive -- 3 units

From 20 to 35 mill. kWhr inclusive -- 2 units

Up to 20 mill. kWhr inclusive -- 1 unit

Extent of Production Hazard and Danger

Extremely hazardous, highly explosive manufacture -- 3 units

Extremely hazardous, hazardous, highly explosive -- 2 units

Manufacture under normal working conditions -- 1 unit

According to the hazard and danger factors, enterprises may be classified as follows:

Three units -- in cases where over 25% of the workers of the enterprise are paid according to higher rates under extremely hazardous working conditions;

two units -- when the number of workers paid according to

higher rates under extremely hazardous working conditions comprises 50% and more of the total number of workers at the enterprise.

B. For enterprises producing artificial leather, rubber- and technical rubber articles, thermosetting plastic goods and rubber tire factories:

Total Gross Production

|                                      |            |
|--------------------------------------|------------|
| Over 600 mill. rub.                  | -- 4 units |
| From 300 to 600 mill. rub. inclusive | -- 3 units |
| From 150 to 300 mill. rub. inclusive | -- 2 units |
| Up to 150 mill. rubl. inclusive      | -- 1 unit  |

Number of Workers

|                             |            |
|-----------------------------|------------|
| Over 3500                   | -- 4 units |
| From 2000 to 3500 inclusive | -- 3 units |
| From 1000 to 2000 inclusive | -- 2 units |
| Up to 1000 inclusive        | -- 1 unit  |

Number of Types of Product

(according to basic nomenclature)

|                               |            |
|-------------------------------|------------|
| Over 30 types                 | -- 4 units |
| From 15 to 30 types inclusive | -- 3 units |
| From 10 to 15 types inclusive | -- 2 units |
| Up to 10 types inclusive      | -- 1 unit  |

Power Consumption

|                                    |            |
|------------------------------------|------------|
| Over 60 mill. kwhr                 | -- 4 units |
| From 30 to 60 mill. kwhr inclusive | -- 3 units |
| From 15 to 30 mill. kwhr inclusive | -- 2 units |
| Up to 15 mill. kwhr inclusive      | -- 1 unit  |

### Extent of Production Hazard and Danger

Extremely hazardous and hazardous manufacture --- 2 units

Manufacture under normal working conditions --- 1 unit

From the factor of danger and hazard involved in the production, two units may be assigned in a case where more than 50% of the workers of an enterprise are being paid at increased rates for extremely hazardous and dangerous working conditions.

### 3. Order of Grouping of Plant Shops According to Wages and Salaries for Engineering and Technical Personnel

In the chemical industry there are several thousand shops that are extremely variegated in regard to their production output, technology and scope of work. For assignment of the shops to groups according to salaries of engineering and technical personnel, the following is taken into consideration: production volume, variety of shop production, complexity of the technological process, number of personnel, working conditions (presence of hazardous or extremely hazardous working conditions), etc.

The factors for assignment of shops to groups according to salaries of workers are approved by the sovnarkhozes. In accordance with the approved factors, shops are assigned to corresponding groups by the director of an enterprise in agreement with the trade-union committee.

The State Committee of the Council of Ministers of the USSR for Problems of Labor and Wages and the VTsSPS have developed and recommended to the sovnarkhozes sample indicators for assignment of shops to groups according to salaries of administrative as well as engineering and technical personnel.

Following the sample indicators, sovnarkhozes develop and approve indicators applicable to the specific peculiarities of the shops of enterprises located in a given economic administrative rayon.

Sample Indicators for Grouping of the Shops of Enterprises of the Chemical Industry according to Salaries of the Engineering and Technical Personnel

([Note:] Resolution of the State Committee of the Council of Ministers of the USSR on Problems of Labor and Wages and by the VTsSPS of 3 September 1958 No 829.)

| Type of products and names of plants and quarries                    | Salary Group | Indicator for gross production volume of     |
|--|--------------|--|
| <b>Chemical Production</b>   |              |  |
| Soda ash plants  | I            | Over 200,000 tons of soda                    |
|  | II           | From 100,000 to 200,000 tons of soda         |
|  | III          | Under 100,000 tons of soda                   |
| Caustic soda plants  | I            | Over 30,000 tons of soda                     |
|  | II           | From 20,000 to 30,000 tons of soda           |
|  | III          | Under 20,000 tons of soda                    |
| Plants for manufacture of electrolytic caustic                       | I            | Over 65 mill. rub.                           |
|  | II           | From 35 to 65 mill. rub.                     |
|  | III          | Under 35 mill. rub.                          |
| Plants for manufacture of barium chloride                            | I            | Over 30 mill. rub.                           |
|  | II           | From 20 to 30 mill. rub.                     |
|  | III          | Under 20 mill. rub.                          |
| Plants for manufacture of sulfuric acid by tower and contact process | II           | Over 150,000 tons of sulfuric acid           |
|  | III          | From 75,000 to 150,000 tons of sulfuric acid |
|  |              | Under 75,000 tons of sulfuric acid.          |

|                            |     |  |
|----------------------------|-----|--|
| Superphosphate plants:     | I   | Over 500,000 tons of superphosphate              |
| a) common superphosphate   | II  | From 200,000 to 500,000 tons of superphosphate   |
| b) granular superphosphate | III | Under 200,000 tons of superphosphate             |
|                            | I   | Over 300,000 tons of superphosphate              |
|                            | II  | From 150,000 to 300,000 tons of superphosphate   |
|                            | III | Under 150,000 tons of superphosphate             |
| Plants for urea production | I   | Over 8,000 tons of urea                          |
|                            | II  | From 4,000 to 8,000 tons of urea                 |
|                            | III | Under 4,000 tons of urea                         |
| Ammonium nitrate plants    | I   | Over 200,000 tons of ammonium nitrate            |
|                            | II  | From 100,000 to 200,000 tons of ammonium nitrate |
|                            | III | Under 100,000 tons of ammonium nitrate           |
| Calcium carbide plants     | I   | Over 100,000 tons of calcium carbide             |
|                            | II  | From 60,000 to 100,000 tons of calcium carbide   |
|                            | III | Under 60,000 tons of calcium carbide             |

|   |     |  |
|---|-----|--|
| Ethyl benzene plants  | I   | Over 10,000 tons of ethyl benzene                                |
|   | II  | From 5,000 to 10,000 tons of ethyl benzene                       |
|   | III | Under 5,000 tons of ethyl benzene                                |
| Salt works  | I   | Over 25,000 tons of salt over 5 kinds of products                |
|   | II  | From 10,000 to 25,000 tons of salt from 3 to 5 kinds of products |
|   | III | Under 10,000 tons of salt up to 3 kinds of products              |
| Plants for nitro lacquer manufacture  | I   | Over 15,000 tons of nitro lacquers                               |
|   | II  | From 8,000 to 15,000 tons of nitro lacquers                      |
|   | III | Under 8,000 tons of nitro lacquers                               |
| Plants for the manufacture of enamels, primers, lacquers and grinder paints | I   | Over 8,000 tons of enamels, primers, etc.                        |
|   | II  | From 4,000 to 8,000 tons of enamels, primers, etc.               |
|   | III | Under 4,000 tons of enamels, primers, etc.                       |
| Automobile Tire Manufacture   |     |  |
| Mastication and mixing plant units  | I   | Over 200 tons of rubber in 24 hours                              |
|   | II  | From 100 to 200 tons of rubber in 24 hours                       |

|                                       |     |  |
|---------------------------------------|-----|--|
|                                       | III | Under 100 tons of rubber in 24 hours             |
| Calender Shops                        | I   | Over 50,000 lin. meters of cord in 24 hours      |
|                                       | II  | From 30,000 to 50,000 lin. meters in 24 hours    |
|                                       | III | Under 30,000 lin. meters in 24 hours             |
| Assembly and vulcanizing shops        | I   | Over 4,000 tire casings in 24 hours              |
|                                       | II  | From 2,000 to 4,000 tire casings in 24 hours     |
|                                       | III | Under 2,000 tire casings in 24 hours             |
| Automobile inner tube plants          | I   | Over 6,000 inner tubes in 24 hours               |
|                                       | II  | From 3,000 to 6,000 inner tubes in 24 hours      |
|                                       | III | Under 3,000 inner tubes in 24 hours              |
| Bicycle tire shops                    | I   | Over 20,000 tires in 24 hours                    |
|                                       | II  | From 10,000 to 20,000 tires in 24 hours          |
|                                       | III | Under 10,000 tires in 24 hours                   |
| Technical Rubber Products Manufacture |     |  |
| Technical die-casting shops           | I   | Over 30 mill. rub. more than 500 persons         |
|                                       | II  | From 15 to 30 mill. rub. from 300 to 500 persons |

|  |     |   |
|--|-----|---|
|  | III | Under 15 mill. rub.<br>up to 300 persons            |
| Other than technical<br>die-casting shops                                  | I   | Over 35 mill. rub.<br>more than 200 persons         |
|  | II  | From 20 to 35 mill. rub.<br>from 100 to 200 persons |
|  | III | Under 20 mill. rub.<br>up to 100 persons            |
| Plants for the<br>manufacture of dipped<br>articles                        | I   | Over 20 mill. rub.<br>over 500 persons              |
|  | II  | From 10 to 20 mill. rub.<br>from 300 to 500 persons |
|  | III | Under 10 mill. rub.<br>Up to 300 persons            |
| Plants for the manu-<br>facture of rubber<br>fibres and neoprene<br>gloves | I   | Over 20 mill. rub.<br>over 200 persons              |
|  | II  | From 10 to 20 mill. rub.<br>from 100 to 200 persons |
|  | III | Under 10 mill. rub.<br>up to 100 persons            |
| Mastication and<br>mixing plant units                                      | I   | Over 80 mill. rub.<br>over 500 persons              |
|  | II  | From 30 to 80 mill. rub.<br>from 200 to 500 persons |
|  | III | Under 30 mill. rub.<br>up to 200 persons            |
| Plants for the manu-<br>facture of rubber-<br>ized cloths                  | I   | Over 150 mill. rub.<br>over 200 persons             |

|  |     |  |
|--|-----|--|
|  | II  | From 75 to 150 mill. rub.<br>from 100 to 200 persons |
|  | III | Under 75 mill. rub.<br>up to 100 persons             |
| Rubber hose shops  | I   | Over 50 mill. rub.<br>over 400 persons               |
|  | II  | From 25 to 50 mill. rub.<br>from 200 to 400 persons  |
|  | III | Under 25 mill. rub.<br>up to 200 persons             |
| Braided hose shops   | I   | Over 40 mill. rub.<br>over 300 persons               |
|  | II  | From 20 to 40 mill. rub.<br>from 150 to 300 persons  |
|  | III | Under 20 mill. rub.<br>up to 150 persons             |
| Factories for the<br>manufacture of<br>conveyor and drive<br>belting | I   | Over 100 mill. rub.<br>over 150 persons              |
|  | II  | From 50 to 100 mill. rub.<br>from 75 to 150 persons  |
|  | III | Under 50 mill. rub.<br>up to 75 persons              |
| Artificial Fiber<br>Production                                       |     |  |
| Plants for the<br>manufacture of<br>viscose silk                     | I   | Over 12 tons of viscose silk<br>in 24 hours          |
|  | II  | From 8 to 12 tons of viscose<br>silk in 24 hours     |
|  | III | Up to 8 tons of viscose silk<br>in 24 hours          |

|   |     |  |
|---|-----|--|
| Plants for the manufacture of viscose staple fiber    | I   | Over 50 tons of staple fiber in 24 hours       |
|   | II  | From 30 to 50 tons of staple fiber in 24 hours |
|   | III | Up to 30 tons of staple fiber in 24 hours      |
| Plants for the manufacture of viscose cord fiber      | I   | Over 40 tons of cord fiber in 24 hours         |
|   | II  | From 30 to 40 tons of cord fiber in 24 hours   |
|   | III | Up to 30 tons of cord fiber in 24 hours        |
| Factory for the manufacture of caprone silk and anide | I   | Over 10 tons in 24 hours                       |
|   | II  | From 7 to 10 tons in 24 hours                  |
|   | III | Up to 7 tons in 24 hours                       |
| Plants for the manufacture of cuprammonium staple     | II  | Over 20 tons in 24 hours                       |
|   | III | Up to 20 tons in 24 hours                      |
| Plants for the production of cellophane               | I   | Over 15 tons in 24 hours                       |
|   | II  | From 10 to 15 tons in 24 hours                 |
|   | III | Up to 10 tons in 24 hours                      |
| Carbon bisulfide plants                               | I   | Over 40 tons in 24 hours                       |
|   | II  | From 20 to 40 tons in 24 hours                 |
|   | III | Up to 20 tons in 24 hours                      |

|                       |     |                                |
|-----------------------|-----|--------------------------------|
| Acetate silk plants   | I   | Over 20 tons in 24 hours       |
|                       | II  | From 10 to 20 tons in 24 hours |
|                       | III | Up to 10 tons in 24 hours      |
| Chlorine fiber plants | III | At all plants                  |
| Lavsan fiber plants   | I   | Over 40 tons in 24 hours       |
|                       | II  | From 25 to 40 tons in 24 hours |
|                       | III | Up to 25 tons in 24 hours      |
| Nitron fiber plants   | I   | Over 50 tons in 24 hours       |
|                       | II  | From 25 to 50 tons in 24 hours |
|                       | III | Up to 25 tons in 24 hours      |

#### 4. Premium Payments to Engineering and Technical Personnel

The salaries of engineering and technical personnel consist of two parts: the base pay established for the employee depending on the position he occupies, on his qualification, length of service and work experience, on the one hand, and of the amounts of premiums paid for raising work standards. If the level of the first portion of the salaries is constant, the level of the second portion depends on the results achieved by every worker in his section, and on his personal productive achievements. In order that the system of premium payments for engineering and technical personnel would be effective, it should promote the mobilization of efforts on the part of such workers towards a fuller utilization of production reserves and improvement of the quality indicators of the work of enterprises.

Yet the system of premium payments to engineering and technical personnel only for the fulfillment and overfulfillment of production output plans is not in agreement with the new conditions, since the Councils of the national economy of the economic rayons have become the centers for the administration of enterprises. The significance of fulfillment of work quotas in supply of products by the enterprises of other economic administrative rayons and the fulfillment of cooperative deliveries to the normal function of enterprises is well known. Yet no provision was made in the rules and regulations for the payment of premiums with regard to these most important conditions. Premiums for the fulfillment and over-

fulfillment of the production plan were also being paid without taking into consideration such an important indicator as the fulfillment of labor productivity quotas. Engineering and technical personnel were not materially interested in lowering the cost of production or in the increase of the earning capacity of the enterprises.

Numerous regulations governing the payment of premiums were being applied at enterprises simultaneously. Taking advantage of this, many administrative, engineering and technical personnel were receiving unwarranted high premiums even with poor functioning of an enterprise. The extent of funds being expended on premiums for the fulfillment and overfulfillment of production plans were not coordinated with the amount of saving resulting from the lowering of the production cost. This led to a situation where frequently enterprises, achieving no saving from lowering the production cost and functioning without profit, expended considerable monies for the payment of premiums. For purposes of regulating the payment of premiums for administrative, engineering and technical personnel of enterprises, and in order to raise their interest in the improvement of the quality indicators of the work of the enterprise, the State Committee of the Council of Ministers of the USSR for Problems of Labor and Wages and the VTsSPS approved in September 1959 Standard Rules and Regulations for the payment of premiums.

At enterprises of the chemical industry the new rules and regulations for premiums is being introduced from 1 January 1960. According to the rules and regulations, administrative, engineering and technical personnel of enterprises of the chemical industry are paid premiums for the fulfillment and overfulfillment of the plan for lowering the production cost on condition of fulfillment of the production plan for a given product, of the labor productivity plan, and of quotas for delivery of products to enterprises of other economic administrative rayons, for cooperative deliveries as well as deliveries for national needs.

An indicator of the plan for lowering of production cost is the plan or reducing expenditures per one ruble of output of goods in percentages of the preceding year's such having been recalculated for actual output and variety of products. Another mandatory condition is the fulfillment of a plan for the lowering of the production cost of the most important types of production, established for the enterprise by a senior organization.

Premiums are also paid to administrative, engineering and technical personnel of enterprises of the chemical industry for overfulfillment of the production plan.

Premiums are paid to administrative, engineering and technical personnel of mining and chemical enterprises on condition of fulfillment of the plan for the development of heavy and strip mining as well as insurance of the planned content of the components in the ore and in the concentrate.

Premiums are paid to administrative, engineering and technical personnel of enterprises and shops (sections) producing consumer goods on condition of fulfillment of the plan for delivery to trade organizations of goods in the established assortment and fulfillment of the production plan for consumer goods of high quality.

Premiums are paid to administrative, engineering and technical personnel of the plant management according to the results of quarterly work. In case of non-fulfillment of the production plan for one or two months of the quarters, the amounts of premiums paid for that quarter are decreased by 20 to 40 percent.

Premiums are paid to administrative, engineering and technical personnel of plant shops according to the results of work for the month.

Workers of basic production shops are paid premiums according to work indicators for the shop. In the absence of indicators with regard to the production cost in a main production shop, the Standard Rules and Regulations provide for the possibility of premium payments to workers according to the saving in the most essential elements of production cost (expenditure of raw materials, supplies, wages, electric power, etc.)

At enterprises having a shopless administrative structure the engineering and technical personnel of production sections for which no indicators of production cost are established by the plan, are paid premiums every month according to indicators of savings in the most essential elements of production cost, or according to indicators of the production performance as a whole, in the absence of over-expenditure of the programmed wage fund for the section, recalculated for the actual volume of work performed.

Workers of auxiliary shops (sections) recruited for the purpose of assuring continuous function of the main shops are paid premiums monthly, according to work indicators of the enterprise as a whole, or of the main shops served by such auxiliary shops (sections), on condition of fulfillment of the planned program for quantitative and qualitative work indicators for their shop (section).

According to previously effective rules and regulations for premium payments for engineering and technical personnel, the amounts of premiums in percentages for fulfillment and overfulfillment of the plan varied depending on the person's position. Management personnel (directors of enterprises, departments, or shops) were allowed higher percentages for the same indicators than other engineering and technical personnel. Such a situation led to an increased discrepancy between the levels of wages of the management personnel on the one hand, and ordinary engineering and technical personnel on the other. The new rules and regulations provide for premiums in the same percentage of the salary regardless of the position occupied.

The amounts of premiums (on a monthly basis) in percentages of the salary for fulfillment and overfulfillment of individual indicators are as follows:

| Nos. | Departments   | For the fulfillment of the plan for lowering production cost | For each tenth of one percent of production cost lowered in excess of the plan | For each one percent of production overfulfillment of production plan |
|------|---|--|--|---|
| 1    | Basic, nitrogen, organic mining, chemico-pharmaceutical, for the manufacture of artificial and synthetic fibers, tire, carbon, black aniline semi-finished products and dyes, synthetic alcohol and synthetic rubber, thermosetting plastics and their technical articles, rubber and asbestos technical articles, chemical shale | up to 15   | up to 1.5  | up to 5   |
| 2    | Paper and pulp, hydrolysis, oxygen, photo-chemical, varnish and paint, rubber foot-wear and rubber goods, sanitary and hygiene, consumers' goods made of plastics, synthetic leather, regenerating  | up to 12   | up to 1.2  | up to 3   |

3 Other branches not listed in paragraphs 1 and 2, as well as the enterprises of all branches of the chemical industry within the jurisdiction of executive committees of the Soviet of Working People's Deputies      up to 10      up to 1      up to 3

Other premium rates are established for administrative as well as engineering and technical personnel of enterprises for which the plan makes no provision for lowering of production cost. In such cases premiums are paid for fulfillment of the production cost plan, for lowering of production cost as compared to the programmed cost, and for overfulfillment of the production plan. The premium rates (based on monthly scales) in percentages of salaries are as follows:

| Nos | Departments  | For the fulfillment of the plan for lowering production cost | For each tenth of one percent of production cost lowered in excess of the plan | For each one percent overfulfillment of production plan |
|-----|--|--|--|---|
| 1   | Basic, nitrogen, organic mining, chemico-pharmaceutical, for the manufacture of artificial and synthetic fibers, tire, carbon black, aniline semi-finished products and dyes, synthetic alcohol and synthetic rubber, thermosetting plastics and their |  |  |   |

|   |   |          |           |         |
|---|---|----------|-----------|---------|
|   | technical articles, rubber and asbestos technical articles, chemical shale  | up to 10 | up to 1   | up to 5 |
| 2 | Paper and pulp, hydrolysis, oxygen, photochemical, varnish and paint, rubber footwear and rubber goods, sanitary and hygiene, consumers' goods made of plastics synthetic leather, regenerating                 | up to 8  | up to 1   | up to 3 |
| 3 | Other branches not listed in paragraphs 1 and 2, as well as the enterprises of all branches of the chemical industry within the jurisdiction of executive committees of the Soviet of Working People's Deputies | up to 8  | Up to 0.8 | up to 3 |

For purposes of encouraging high quality production output and preventing the production over and above the plan of products having a limited market, the rules and regulations provide for the following: for enterprises (shops having quality quotas, lower quality production is allowed only within the established program ratio of lower and higher qualities within the gross production volume; the output produced above the plan, and which has a limited market, shall not be taken into account for the tabulation of premiums for the administrative or engineering and technical personnel.

The combined total amount of premiums paid to any single worker according to all the indicators (except for premiums for socialist competition) is limited, when tabulated for any one month, to 0.6 of the monthly salary.

Employees who actively promote the fulfillment and overfulfillment of planned programs, may be given premiums by the directors of enterprises in agreement with the factory and plant committees of a trade union on a one-time basis, but not more than once in any quarter, not to exceed 0.5 of their monthly salary. The combined sum of the funds spent on premiums for the above group of workers shall not exceed 10 percent of the fund of their salaries for the corresponding period.

Payment of premiums to administrative or engineering and technical personnel for the fulfillment of the plan for lowering production cost, for lowering the production cost in excess of the plan, and for overfulfillment of the production plan, may be made only at the expense of, and within the limits of, the wage fund of the enterprise.

On the basis of the Standard Rules and Regulations, the sovnarkhozes, ministries, departments, and obl(kray) ispolkom in cooperation with the respective trade-union organizations, approve regulations for the payment of premiums for the administrative, engineering and technical personnel of enterprises of the chemical industry, establishing the extent of premiums for individual enterprises.

The extent of premiums for various enterprises should be established depending on the complexity and nature of the production, on the attained level of utilization of projected capacities and reserves for the lowering of production costs.

The extent of premiums for individual shops is established by the director of an enterprise in agreement with the factory and plant trade-union committee.

## Chapter Seven

### WORK TIME REGIMES AND PRODUCTION SCHEDULES

#### 1. Work Time and Rest Period Norms.

At enterprises of the chemical industry, depending on working conditions and the degree of production hazards, the length of the working day is seven and six hours.

However, in cases of continuous production process at chemical enterprises it is impossible to organize a seven-hour shift. The necessity, therefore, arises to organize a three-shift working day of eight hours per shift, with compensation by additional days off for the hours of overtime work. For that purpose it is necessary to determine the normal number of working hours on an average per month with a seven- and six-hour working day.

According to the current legislature of the USSR, workers and other employees after six working days are given a rest period of a minimum of 39 hours.

Altogether, there are 52 days of rest (every week in the year 365:7). Besides the weekly days of rest, there are the following non-working days: 1 January, 1 and 2 May, 7 and 8 November, and 5 December, or a total of six non-working days (holidays) in the year.

By decree of the Council of Ministers of the USSR of 8 March 1965, the length of the working day preceding a holiday or a day off has been established at six hours.

On an average, in a calendar year there are:

- a) 52 weekly days of rest;
- b) six non-working days (holidays);
- c) 52 days preceding days off, with a working day six hours long;
- d) four days preceding holidays (the eve of 1 January, 1 May, 7 November and 5 December), with a six-hour working day.

Hence, the average yearly number of work hours per month is:

- a) with a seven-hour working day:

$$\frac{[365 - (52 + 6 + 52 + 4)] \times 7 + (52 + 4) \times 6}{12} = 174.4$$

- b) with a six-hour working day:

$$\frac{[365 - (52 + 6)]}{12} = 153.5$$

This average monthly work-time norm serves as a basis for the development of shift schedules.

The actual number of workhours in some months varies depending on the number of days off in a given month. For example, with weekly days of rest on Sundays, the monthly norm of work hours is:

- a) In October 1959 there were 31 calendar days, of which four were days off and four days with a shortened working day on the eve of days off. Hence, the number of working days with a normal length of seven hours was  $(31 - 4 - 4) = 23$ , and the number

of work hours during the month was  $23 \times 7 \times 4 \times 6 = 185$ ; with a six-hour working day, the number of work hours for the month was  $(31 - 4) \times 6 = 162$ .

b) In November 1959 the number of calendar days was 30, whereof four were days off, two were holidays, and four were days preceding of holidays and days off. Hence, the number of working days of a normal seven-hour length was  $(30 - 4 - 2 - 4) = 20$ , and the number of work hours for the month was  $20 \times 7 + 4 \times 6 = 164$ ; with a six-hour working day the number of work hours for the month was  $(30 - 4 - 2) \times 6 = 144$ .

In continuous process productions, instead of the general weekly day of rest, days of rest are established according to the shift schedules for individual shops, sections, and brigades in such a manner that the facilities would function normally; in such a case each worker is given the required number of days off per month with an average length of the rest period of a minimum of 39 hours.

During the day workers must be allowed time for rest and meals. A period of time of not less than half an hour is allowed not later than four hours after commencement of work.

The time and duration of the periods are established by internal regulations. Workers may utilize these periods according to their wish, since they are not included in the work time.

The beginning and end of the working day and periods of meal time are regulated for each enterprise according to its internal rules. Decisions with regard to such questions should be based both on production conditions, and on conditions that provide for the maximum convenience of workers. In particular, it is necessary to take into consideration municipal transportation facilities, as well as the potentials of public catering establishments (factory and plant dining rooms and lunch counters), in order to avoid unnecessary delays in food servicing. At small enterprises it is advisable to establish the same time for the beginning and end of the work, as well as for meal-time periods, for all workers. At large enterprises such time may be established at different hours for separate groups, shops, or departments.

Meal-time intervals are established within a shift, but not at the expense of work time.

In case of continuous process production, where due to the conditions of the technological process interruptions of work are not permitted, workers are allowed the possibility of having meals during the shift, by taking turns, substituting one another at the places of work, without leaving the shop and without stopping the equipment (special places must be provided in the shops for this purpose). The time taken by such periods is included in the work time.

The work time regime may vary depending on the operating conditions of the shift, and also on whether or not a given process is continuous.

For shift work with continuous and intermittent sequence production, various versions of work schedules, as well as deviations from the established number of work hours per month, are possible.

## 2. Work Schedule in an Intermittent Sequence Production With a Seven-Hour Working Day.

With a single shift working and a general weekly day of rest, the following work schedule is applied:

Days ..... 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Working hours 7 7 7 7 7 6 - 7 7 7 7 6 - 7 7

With such a schedule the yearly-average number of work hours per month would be:

$$\frac{(365 - 114) \times 7 + (52 + 4) \times 6}{12} = 174.4$$

which is in full agreement with the monthly-average norm of work time.

The actual number of work hours in some months will vary somewhat depending on the number of days off.

With two shifts working, the above schedule remains the same. The workers work alternately, one week in the first shift, and the next week -- in the second shift, according to the following order:

|              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |
|--------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|
| Days         | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| First shift  | A | A | A | A | A | A | O | B | B | B  | B  | B  | O  |    |
| Second shift | B | B | B | B | B | B | O | A | A | A  | A  | A  | O  |    |

Here the following designations are used: A is the first brigade (or worker); B -- the second brigade (worker); O -- day of rest.

A three-shift work schedule with a general weekly day of rest is used at rubber and tire plants, thermosetting plastic and mineral factories as well as at other enterprises with an intermittent production process.

| Days         | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|--------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|
| First Shift  | A | A | A | A | A | A | O | B | C | B  | B  | B  | B  | O  | C  | C  |
| Second Shift | B | B | B | B | B | B | O | C | B | C  | C  | C  | C  | O  | A  | A  |
| Third Shift  | C | C | C | C | C | C | O | A | A | A  | A  | A  | A  | O  | B  | B  |

Here A is the first brigade (first worker); B -- second brigade (second worker); C -- third brigade (third worker); O -- rest.

On the eve of holidays and days off the length of each shift is six hours. On holidays no work is performed. With work during the night time the length of a shift is shortened by one hour (article 96 of the Labor Code).

The above schedule is compiled taking into consideration the fact that each work place is served by three workers (brigades) who work alternately in all shifts.

During the days of rest of the shift brigades of the main production shops, maintenance workers carry out repairs of equipment and prepare it for uninterrupted operation during the following week.

### 3. Work Schedule in a Continuous Process Production With a Seven-Hour Working Day

In a continuous process production, seven-hour shifts maintaining the same hours for the start and end of the shifts cannot be established. Because of this eight-hour shifts are set up, compensating the workers by additional days off for overtime work; this is achieved by application of four-brigade schedule No 1.

#### Shift Schedule No 1 (Four Brigades)

##### Continuous process production

##### Initial Data

|                        |   |                                  |     |
|------------------------|---|----------------------------------|-----|
| Length of shift, hours | 8 | Overtime work hours              | 8.1 |
| Number of brigades     | 4 | Number of rest periods per month | 5.6 |

|  |       |   |    |
|--|-------|---|----|
| Average number of times<br>of reporting for work,<br>per month | 22.5  | Average period of<br>rest during changes<br>of shift, hours | 48 |
| Actual monthly-average<br>number of working<br>hours           | 182.5 |   |    |
| Working-time norm per<br>month, hours                          | 174.4 |   |    |

| Shifts | Hours | Days of the month                          | Rest period<br>when chang-<br>ing shift,<br>hours |
|--------|-------|--|---|
|        |       | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16     |   |
| I      | 0-8   | A A A A B B B B C C C C D D D D I - II -   | 48  |
| II     | 8-16  | C D D D D A A A A B B B B C C C C II-III - | 48  |
| III    | 16-24 | B B C C C C D D D D A A A A B B III- I -   | 48  |
| Rest   |       | D C B B A D C C B A D D C C A A            |   |

Here A is the first brigade (first worker); B -- the second brigade (second worker); C -- the third brigade (third worker); D -- fourth brigade (fourth worker).

According to the above schedule each brigade (worker) works in eight-hour shifts and after four days of work in this shift has a 48-hour rest. The alternation of shifts is carried out consecutively. Each brigade (worker), having worked four days in the first shift, after 48 hours begins work in the second shift. Having worked four days in the second shift, after 48 hours of rest, he begins to work in the third shift. After four days of work in the third shift, and a 48-hour rest, the next cycle begins.

According to this schedule the brigades are given no rest days on the generally established weekly days off; furthermore, each brigade (worker) works an eight-hour shift on the eve of the day of rest (as on other days). According to the above schedule work is performed on holidays also. With a total number of working hours per year being  $365 \times 24 + 8,760$ , the number of hours to a single brigade (a single worker) per month is on an average

$$\frac{8,760}{12 \times 4} = 182.5 \text{ hours}$$

This number of working hours exceeds the normal number of working hours with seven-hour shifts and a seven-day week by 182.5 - 174.4 = 8.1 hours.

The actual number of work hours in any month varies for individual brigades (workers) depending on the number of days of rest that fall on that month and the number of days in the month.

Corresponding additional payments of wages are made for overtime, as well as for night work.

With a view toward preparation of enterprises of the chemical industry for change over to a shortened working day, the former Ministry of the Chemical Industry and the TsK (Tsentral'nyy Komitet -- Central Committee) of the trade union of workers of the chemical industry in May 1957 approved a number of standard shift schedules for continuous process productions. Schedules No 2 and No 3 were also recommended, besides the above-adduced schedule No 1.

#### Shift Schedule No 2 (Four Brigades)

#### Continuous Process Production

##### Initial Data

|  |       |   |     |
|--|-------|---|-----|
| Length of shift, hrs.                                    | 8     | Overtime work hours                                   | 8.1 |
| Number of brigades or workers                            | 4     | Number of rest periods per month                      | 4.5 |
| Average number of times of reporting for work, per month | 22.5  | Average period of rest when changing of shifts, hours | 56  |
| Actual monthly-average number of working hours           | 182.5 |   |     |
| Working-time norm per month, hours                       | 174.4 |   |     |

| Days of the month |       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |                   |  |
|-------------------|-------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|-------------------|--|
| Shifts            | Hours | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15                | Rest period when changing shift, hours |
| I                 | 0-8   | A | A | A | A | B | B | B | B | B | C  | C  | C  | C  | C  | from I to II - 48 |  |
| II                | 8-16  | C | D | D | D | D | A | A | A | A | B  | B  | B  | B  | B  | from II to III-48 |  |
| III               | 16-24 | B | B | C | C | C | C | D | D | D | D  | A  | A  | A  | A  | from III to I -72 |  |
| Rest              |       | D | C | B | B | B | A | D | O | C | C  | B  | A  | D  | D  | D                 |  |

Shift Schedule No 3 (Four Brigades)

Continuous Process Production

Initial Data

|  |       |  |     |
|--|-------|--|-----|
| Length of shift, hours                               | 8     | Overtime work, hours                               | 8.1 |
| Number of brigades or workers                        | 4     | Number of rest periods per month                   | 7.5 |
| Average number of times reporting for work per month | 22.5  | Average period of rest when changing shifts, hours | 40  |
| Actual monthly-average number of working hours       | 182.5 |  |     |

Days of the month

| Shifts | Hours | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Rest period when changing shifts, hrs. |
|--------|-------|---|---|---|---|---|---|---|---|---|----|----|----|--|
| I      | 0-8   | A | A | A | B | B | B | C | C | C | D  | D  | D  | from I to II - 48                      |
| II     | 8-16  | C | D | D | D | A | A | A | B | B | C  | C  | C  | " II to III- 48                        |
| III    | 16-24 | B | B | C | C | C | D | D | D | A | A  | B  | B  | " III to I - 24                        |
| Rest   |       | D | C | B | A | D | C | B | A | D | C  | B  | A  |  |

Schedule No 2 provides for five days of work with two rest periods of 48 hours each when changing shifts (from one shift to another) and with one rest period of 72 hours (when changing from the third to the first shift). Schedule No 3 provides for three working days with two rest periods of 48 hours each and one 24-hour rest (when changing from the third to the first shift). All three schedules assure an equal balance (ratio) of working time -- 182.5 hours per month with a norm of 174.4 hours.

Most enterprises of the chemical industry have adopted schedule No 1 as the most rational in respect of alternation of work and rest.

In cases where with continuous process production, due to technological conditions, a half-hour interval for each shift may be afforded either to all simultaneously or alternately), the work may be performed in accordance with the above four-brigade schedule; in such a case the length of a shift (for the workers) will be not 8, but 7.5 hours.

The total number of work hours (for the workers per year) with such alternation of work scheduling will be:  $365 \times 22.5 = 8,212.5$ , and on average per month

$$\frac{8,212.5}{12 \times 4} = 171.1 \text{ hours}$$

As compared to the regular number of work hours with seven-hour day shifts and a seven-day week, there will be a shortage of working time:  $174.4 - 171.1 = 3.3$  hours (on an average for the month).

Selection of schedules with a shift length of 8 or 7.5 hours is made depending on the nature of the technological process and the operational requirements of the production aggregates and sections.

#### 4. Work Schedule With Continuous Process Production and With a Six-Hour Working Day

In plants where the length of a working day is established at six-hours, 24-hour continuous work is achieved by having four six-hour shifts with the assignment of five workers for consecutive operation of each work place (a five-brigade schedule). The length of a working day on the eve of days-off and days before holidays with a six-hour working day is six hours. According to such a schedule each worker after five working days gets a rest of 48 hours, after which he changes to the next shift. On an average each works at his principal place of work 24 working days per month (the norm is 25.6 days). Each worker, therefore, works 1.6 days less than the established norm per month. In some months this

shortage varies from one to two days. For full utilization of time, the administration may recruit workers for work outside the schedule (during the 48-hour intervals) and as substitutes for those absent, due to illness or other reasons, from the principal places of work.

Besides the shift schedules, a work schedule indicating the time for reporting for work is compiled, when (in which shift) and where (at which place of work) each worker or each brigade will work on any specific day of the month.

This schedule for reporting for work is as a rule compiled for a month ahead and is made known to workers not later than on the 29th of the preceding month.

#### 5. Measures for Further Shortening of the Length of a Working Day.

During the seven years (1959-1965) measures will be introduced for further shortening of the length of the working day and work week.

Beginning with 1962 it is planned to transfer all workers and other personnel with a seven-hour working day to a 40-hour work week. Beginning in 1964 it is planned to start a gradual transfer of workers engaged in underground work and in [Cont'd next page]

#### Shift Schedule (Five Brigades)

#### Continuous Process Production

#### Initial Data

|  |       |
|--|-------|
| Length of shift                                      | 6     |
| Period of change of shifts, days                     | 25    |
| Number of brigades (workers)                         | 5     |
| Average number of times reporting for work per month | 24    |
| Actual monthly-average number of working hours       | 146   |
| Working-time norm per month, hours                   | 153.5 |
| Shortage in working time as against norm, hours      | 7.5   |
| Number of rest periods per month                     | 4.8   |
| Average duration of rest when changing shifts, hours | 48    |

Days of the month

| Shifts | Hours | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|--------|-------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|
| I      | 0-6   | A | A | A | A | A | B | B | B | B | B  | C  | C  | C  | C  |
| II     | 6-12  | D | E | E | E | E | A | A | A | A | A  | B  | B  | B  | B  |
| III    | 12-18 | C | C | D | D | D | D | E | E | E | E  | E  | A  | A  |    |
| IV     | 18-24 | B | B | B | C | C | C | C | D | D | D  | D  | D  | E  |    |
|        | Rest  | E | D | C | B | B | A | E | D | C | C  | B  | A  | E  | D  |

Days of the month

| Shifts | Hours | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | Length of<br>rest when<br>changing<br>shifts,<br>hours |
|--------|-------|----|----|----|----|----|----|----|----|----|----|----|--|
| I      | 0-6   | C  | D  | D  | D  | D  | D  | E  | E  | E  | E  | E  | I-II-48  |
| II     | 6-12  | B  | B  | C  | C  | C  | C  | C  | D  | D  | D  | D  | II-III-48  |
| III    | 12-18 | A  | A  | A  | B  | B  | B  | B  | C  | C  | C  | C  | III-IV-48  |
| IV     | 18-24 | E  | E  | E  | E  | A  | A  | A  | A  | A  | B  | B  | IV-I- 48   |
|        | Rest  | D  | C  | B  | A  | E  | E  | D  | C  | B  | A  | A  |  |

[Text cont'd]

occupations with hazardous working conditions, to a 30-hour work week (five working days of six hours, with two days off), and for all other workers -- to a 35-hour work week (five working days of seven hours, with two days off); the completion of these measures is planned for sometime between 1966 and 1968. The adoption of a shortened working day and a lesser number of working days per week will be achieved without any reduction in wages.

As a result, the USSR will have the shortest working day and the shortest work week in the world. This will be a great achievement of socialism, the fulfillment of the working people's dream of many centuries.

Guided by decisions of the XXI Congress of the KPSS, and taking into consideration the successful fulfillment of the State plan for development of the national economy of the USSR for 1959 -- the first year of the Seven-Year Plan, the Central Committee of the KPSS, the Council of Ministers of the USSR and VTsSPS, in September 1959, adopted a resolution on the time limit of the change-over to the shortened working day and regulation of wages for workers and other employees by branches of the national economy and by economic rayons.

The resolutions point out that the change-over to a shorter working day and simultaneous regulation of wages first of all in the main branches of heavy industry have been important sources of the further growth of socialist economy and of the material and cultural level in the life of workers and other employees. The material interest of workers in the growth of production and rise of labor productivity has increased, the fulfillment of national economy plans by enterprises has improved, and with the shortened length of the working day the earnings of workers and other employees have not only been maintained, but have, in conjunction with new and higher rates and salaries, increased substantially, especially in the case of lower-pay workers and employees.

The Central Committee of the KPSS, the Council of Ministers of the USSR and the VTsSPS have recognized the necessity of achieving the changeover of all workers and other employees within the national economy to a seven-hour working day, and of workers of the leading skills engaged in underground work, to a six-hour working day, within the following time:

In the industry of the rayons of the North, the Far East, Siberia, the Urals, Kazakh SSR, the city of Moscow and Moscow oblast -- in the fourth quarter of 1959 -- fourth quarter of 1960, and in the remaining economic rayons -- in the third -- fourth quarter of 1960;

In the building industry and geological-exploration work in the rayons of the North, Far East, Siberia, the Urals, Kazakh SSR -- in the second quarter of 1960, and in the other economic rayons -- in the fourth quarter of 1960;

In transport and communications -- in the fourth quarter of 1959 -- fourth quarter of 1969;

In State enterprises of rural economy -- during the fourth quarter of 1960;

In scientific-research institutions and design agencies -- during the second-fourth quarters of 1960;

At enterprises and organizations of commerce, public catering, purchasing and technical material supply, in education, public health, cultural establishments, arts, the State machinery and other non-productive establishment, organizations and institutions - in the third and fourth quarters of 1960.

The change-over to a shortened working day for workers, engineering and technical personnel and other employees of industry and construction, will be achieved simultaneously with the regulation of wages and salaries.

At enterprises and in organizations of transport and communications, sovnarkhozes, scientific-research institutions and design agencies, the transfer of workers, engineering and technical personnel and other employees to new wage standards will be achieved in 1960 - 1961.

Workers, engineering and technical personnel, and other employees of enterprises and organizations of commerce, public catering, purchasing, technical-material supply, organizations and institutions of education, public health, culture and the arts, State machinery and other non-production branches will be changed over to the new wage standard in 1962.

The resolution adopted has approved new higher wage rates and new wage scales for workers and new higher salaries for engineering and technical personnel.

The right to determine date lines for the change-over to a shortened working day and introduction of new wage standards for workers and other employees by individual enterprises, building, constructions, and organizations, has been given to the Councils of Ministers of the union republics, the Ministries and departments of the USSR, sovnarkhozes, and obl(kray)ispolkoms in agreement with the respective trade-union organs, within limits provided for by a resolution with regard to general dates.

The Central Committee of the KPSS, the Council of Ministers of the USSR and the VTsSPS have appealed to workers, engineering and technical personnel, and other employees to raise even higher their work activity and creative initiative in the discovery and fullest realization of internal production reserves in order that the change-over to a shorter working day at each enterprise and construction would promote production growth and increased labor productivity, and, based thereon, improvement of the material welfare and cultural level of workers.

## Chapter Eight

### PRODUCTION PLAN OF AN ENTERPRISE

#### 1. The Tekhpronfinplan of an Enterprise

The Great October socialist revolution overthrew the bourgeoisie rule and abolished private ownership at the expense of production. The nation's resources were pooled into a single economy on a nationwide scale.

The new economic conditions created in the country produced new objective laws of economic development, in particular the law of a planned, proportional development of the national economy.

The effect of this law caused not only the possibility, but even the necessity of planning both the national economy as a whole, and individual enterprises.

Plans for the development of the national economy of the USSR embody the economic policy of the Communist Party and of the Soviet state, directed toward every possible development of all branches of the national economy and, first of all, of heavy industry -- metallurgical, machine building, mining, petroleum, chemical, etc. The powerful growth of heavy industry is a decisive factor in the development of the entire economy of the country, the strengthening of its defensive capacity, and further improvement of the welfare of the Soviet people.

The most important requirement of the law of planned proportional development of the national economy is observance of the necessary ratios in the development of individual branches of the national economy, achieved through a balanced planning method. According to such a method the resources and the demands of the national economy for such resources are determined.

The system of planning the national economy of the USSR provides for the preparation of current as well as long-term plans.

Long-term plans are developed for several years ahead (five, seven and longer). Current plans encompass shorter periods of time (a year, a quarter, a month).

Determination of the main directions and channels for development of the country's economy in accordance with problems posed by the Communistic Party at every stage of development is possible only on the basis of long-term plans. Long-term planning makes it possible to reflect the nature of the technical progress in various branches of the national economy and assures centralized management for the economic progress of the entire nation. At the same time, it should create conditions for every possible development of local initiative toward utilization of all reserves for the growth and perfection of production, and toward improving the material and cultural standard of the people.

The reorganization of the administration of industry and construction, carried out in 1957, made possible the introduction of a series of measures directed toward strengthening the planning principle in the development of the socialist economy and improvement of the system of planning the national economy.

Since 1959, the previously effective method of development and ratification of yearly national economy plans was abolished. The planning of the national economy is now based on long-term plans with a distribution of quotas by years, by individual branches, by union republics, by economic administrative rayons and by enterprises.

Thus, the inadmissible discrepancy which had existed previously between long-term and current planning was eliminated. The integral coordination of current and long-term planning assumes the existence of a long-term plan of development for each enterprise.

The basis of the planning system are the plans compiled by the enterprises, sovnarkhozes and departments, and based on control figures of long-term plans developed by the Gosplan SSSR (Gosudartvenny Komitet Planirovaniya SSSR -- State Planning Committee of the USSR) with the participation of the Gosplans of the union republics, ministries and departments of the USSR and approved by the TsK of the KPSS and by the Council of Ministers of the USSR.

On the basis of these control figures, the Councils of Ministers of the union republics established control figures for the sovnarkhozes and departments, which in turn determine the control figures for the enterprises.

On the basis of the established control figures and direct economic connections (taking into consideration their future development), enterprises work out long-term plans with a distribution of yearly quotas. These plans are discussed by collectives of enterprises and become effective upon approval by the sovnarkhozes.

Sovnarkhozes achieve integration of plans of the enterprises under their jurisdiction within the boundaries of the corresponding economic administrative rayon and, taking into account any direct connections with other rayons, compile combined long-term plans for a given rayon.

Ministries (departments) of the USSR and of the union republics and local Soviets of Working People's Deputies study in a similar manner the enterprises under their jurisdiction, and compile long-term plans for the ministry (department), oblast', kray, or autonomous republic.

The Councils of Ministers of the union republics verify the coordination of the long-term plans compiled by the sovnarkhozes, ministries (departments) of a republic and local Soviets of Working People's Deputies against the established control figures, and approve the combined long-term plans for the development of the national economy of the respective union republic.

Modifications in the economic relationships between enterprises may become necessary in the course of fulfillment of long-term plans, and, therefore, in accordance with the requirements of the national economy, such modifications are, when needed, introduced into the yearly programs of long-term plans.

Modifications are entered into long-range plans in the following order:

The Gosplan of the USSR submits to the Council of Ministers of the USSR for approval its suggestions for modifications of programs of the long-term plan for the coming year not later than four months prior to the beginning of the year.

On the basis of modifications approved by the Council of Ministers of the USSR, the Councils of Ministers of the union republics approve the changes for the sovmarkhozes and departments, which in turn enter the changes in the planned yearly quotas by enterprises.

Not later than November 15 of the preceding year, enterprises enter the required modifications and changes into the yearly plans approved by them, and on their basis develop the tekhpromfinplans (current yearly plans), distributed by quarters.

The tekhpromfinplans provide for an all-round utilization of the production possibilities and resources of the economic rayons in the general interests of the State, as well as on the basis of maintenance and development of rational economic relationships between enterprises, rayons and union republics.

The tekhpromfinplans of enterprises must be approved by the directors of the enterprises not later than one and one-half months after approval of the State plan for the development of the national economy of the USSR.

The plan of an enterprise comprises a definite program for the realization of the directives of the national-economic plan, and is subject to compulsory fulfillment. Non-fulfillment by an enterprise of a plan affects the level of the fulfillment of the entire national-economy plan. Overfulfillment of plans by enterprises assures a faster growth of the national economy and greater strengthening of the country's might.

The possibility of overfulfillment of plans is assured by the advantages of socialistic production methods and by the progressive socialistic forms of work scheduling, in particular by the development of socialist competition. The participation of workers in socialist competition promotes the fulfillment and overfulfillment of the programs by each worker, assuring thereby the fulfillment of a plan by a shop or plant.

Planning by a factory or plant embraces the following:

- a) The basic or economic and production activity of the enterprise;

b) Building activity, that is, the construction of individual objects, expanding and reconstruction of going enterprises, accomplished by local means, independent of budget cost of the building or erection work.

Capital building programs are separate and are prepared by organs of capital construction separately from the main activity plan.

The plan of a chemical factory or plant pertaining to its prime activity embraces the following:

- 1) The chemical industry production;
- 2) the work of the auxiliary shops (mechanical repair, power plant, transport, etc.);
- 3) the work of subsidiary industries (timber cutting, peateries, etc.);
- 4) the work of non-industrial agencies
- 5) supply and marketing activities;
- 6) financial activity.

The main goals of plant or factory planning comprises the following:

- 1) the finding of intra-plant reserves for purposes of assuring the growth of labor productivity, the lowering of production cost, and raising the earning capacity of the enterprise.
- 2) Carrying the planned quotas down to the level of individual shops, sections, brigades, and places of work.
- 3) Development of a plan of industrial engineering measures for better utilization of production facilities and manpower, the assurance of smooth functioning of the enterprise, introduction of modern standards, utilization of advanced experience of the best collectives and production experts, as well as of the achievements of science and technology.
- 4) Organization of the fulfillment of the plan according to all indicators and the regulation of the operation of the enterprise by means of a distribution of the planned programs among the staff, the finding of causes hampering the steady fulfillment of the plan, establishment of operating production quotas.

5) The enlistment of a large number of workers of the enterprise for the development of the plant program and for daily control of production.

Thus, factory or plant planning consists not only of the development of a plan of the factory's operation, but also of the organization and fulfillment of such a plan.

The experience of the more advanced enterprises of the chemical industry shows that the best results in factory planning are attained by those enterprises in which an economic consideration is included, a systematic analysis of the economic and production activity is carried out, and the work of innovation and invention is well organized.

Development of the tekhpromfinplan is the most important stage in the preparation of an enterprise toward the fulfillment of the State plan for the forthcoming year.

The development of the tekhpromfinplan is organized by a planning department and is executed by all the sections of the plant management and shop structure under the direct supervision of the director and chief engineer of the plant.

A most essential role in the development of a tekhpromfinplan and in the effort toward its realization is played by the public organizations of an enterprise. For the purpose of reducing the period of time required for its preparation, and to assure its timely approval beginning with the III quarter of the current year, the development of the organizational and technological measures and calculation of planning norms is begun, both for the main and for the auxiliary shops and activities, as well as for labor protection, etc.

The tekhpromfinplan of an enterprise is developed on the basis of progressive technical and economic norms of utilization of the production facilities and manpower.

The main types of technical and economic planning norms include:

- 1) Norms for the utilization of production means:
  - a) shut-down time required for the maintenance and repair of equipment;
  - b) the period of time between two regular repair jobs.
- 2) Efficiency of the equipment (norm of equipment utilization according to its maximum performance).
- 3) Input-output factors of raw materials, supplies, fuel and electric power.

- 4) Production norms.
- 5) Time unit standards.
- 6) Operating norms.

On the basis of the above norms, corresponding indicators for the tekhpromfinplan are calculated.

The tekhpromfinplan of enterprises of the chemical industry consists of the following basic sections:

- 1) Plan for organizational and technical measures.
- 2) Production program.
- 3) Plan for material and technical supply.
- 4) Labor and wage plan.
- 5) Production cost plan.
- 6) Financial plan.

All the sections of the tekhpromfinplan are developed on the basis of an analysis of performance for the preceding period. Such an analysis makes it possible to provide for the elimination of losses and defects that occurred in the function of the enterprise, to develop reserves in all areas of the plant's economy, and to outline measures for better utilization of production means and manpower in the year for which the plan is being developed.

One of the conditions of correct organization of the planning and of successful fulfillment of the plan indicators is systematic and timely control of the fulfillment of the plan.

## 2. The Plan for Industrial Engineering Measures.

The plan for industrial engineering measures embraces all the planned improvements and developments in the field of organization and production engineering. The plan should provide for inclusion of scientific and technical achievements, propagation of advanced working methods, raising the workers' qualifications, improvement of working conditions. The adaptation of inventors' and production experts' suggestions, form a special section of the plan.

The plans for industrial engineering measures provides for efforts directed toward elimination of "weak places" and losses

in production, which hamper full utilization of the resources of an enterprise.

The plan indicates the time limit for fulfillment of each measure, the persons assigned to carry them out, their effectiveness and the funds required.

The plans for industrial engineering measures must constantly be corrected and supplemented, taking into consideration new quotas (goals) arising before the enterprise, suggestions by efficiency experts, advanced working experience of other enterprises and directions from senior organizations.

For purposes of better utilization of the work of inventors and efficiency experts at an enterprise, special thematic plans are developed, wherein the production "weak points" for each shop are indicated. For the development of the thematic plans the administration recruits public organizations, leading workers, inventors, engineering and technical personnel. At numerous enterprises complex brigades of inventors and efficiency experts are organized.

During the development of the plan of industrial engineering measures the effectiveness (useful result) of each measure is determined.

### 3. Production Capacities

The production capacity of an enterprise is determined by the maximum-possible production output for a year. The capacity is calculated on the basis of full utilization of the entire plant equipment, use of advanced technical norms, equipment productivity, adaptation of advanced technology, advanced methods of work scheduling, and elimination of "weak points" in production.

Each department of a chemical plant represents a complex of inter-connected apparatuses or plant units. The capacity of each apparatus is expressed in units of natural production output. The capacity of a shop (department) is determined by adding up the capacity of individual apparatuses (on the basis of planned norms of expenditure of intermediates) into units of the end product output of the shop.

The capacity of the equipment is calculated on the basis of the technical norms of its use.

A norm of the use of equipment in time represents the ratio of operating time of the machines or apparatuses to the total calendar time in the planned period.

For the calculation of the capacity, the yearly working-time fund for the equipment is established, taking into consideration the shift scheduling of the work and the periodic idle time of the apparatuses due to repairs (current, average and capital) with the least amount of time spent for this purpose by the best maintenance brigades.

[Note: The time required for capital overhaul of equipment with the time between repairs of over one year is taken into account for the year the repair is performed].

The time spent for unavoidable technological shut-downs of equipment (for cleaning purposes, change-over from one production process to another, etc.) which may not be combined with idle time due to repairs, must also be taken into account. However, such losses of time must be in strict agreement with the norms of the technological regulations or the operating rules.

The yearly working-time fund for continuously functioning shops and productions is calculated on the basis of the calendar number of days in the year, but with deduction of time spent on maintenance and technological stoppages of the aggregates.

For continuously operating shops and productions, the yearly working-time fund is determined on the basis of the calendar number of days in the year less days off and holidays. Time used for repairs during working time is deducted from the fund thus obtained.

For the calculation of the production capacity, all the existing equipment (regardless of its condition) installed by the beginning of the fiscal year is taken into consideration (by installed equipment, equipment turned over for operation is understood), and assigned to the production shops (active or inactive due to breakdown, overhaul, adjustments, reserve, reconstruction or conservation, etc.). Standby equipment scheduled to replace self-contained unit equipment, is not taken into consideration.

The calculation of the production capacity for the end of the fiscal year must include all equipment scheduled for use in accordance with the plan for capital improvements and the plan for industrial engineering measures.

In some certain multi-assortment branches of the chemical industry the same apparatuses are assigned for the manufacture of a number of products. Such products include aniline dyes, varnishes, artificial resins, etc. Each type of product may have its particular raw materials, its technological regime, its marketing outlets, and therefore, the capacity of the apparatuses will vary depending on the type of products.

#### 4. Production Program.

The Production Program contains quotas for production output for the period planned in natural and cost indicators.

The most essential part of the production program of an enterprise is formed by the planned quotas for the nomenclature and variety of production in natural units of measurement. The natural indicators of the production volume play an important role not only in the compilation, but also in verification of the fulfillment of the plan. Fulfillment and overfulfillment of the plan for the gross

product output at the expense of production of secondary articles over and above the planned production, and at the expense of non-fulfillment of the plan for the output of the most essential types of products is an inadmissible breach of planning discipline.

The production volume of each type of manufacture is called the gross production.

For chemical productions, weight or volume units having a definite content of the basic substance in most cases, serve as the natural units of measurement. Thus, for example, sulfuric acid is planned and calculated for 100% (in monohydrate), ordinary superphosphate -- is calculated for 18.7% content of  $P_2O_5$ , etc.

The gross production of an enterprise as a whole is its production-volume indicator.

The gross production of an enterprise cannot be expressed in natural units of measurement, because it is characterized by diversified composition.

The gross production of a chemical plant includes:

1) Finished products of the main production shops (including consumer goods) designated for outside delivery.

A product is finished if it has passed through all the stages of the production process provided for by the technological regime, is fully completed, agrees exactly with the established standards or technical conditions, and has been accepted by the section of technical control and marketing division; in a number of cases it has to be delivered into storage for finished articles or accepted at the plant by a customer's representative.

Individual mass types of production manufactured at enterprises of the chemical industry (ammonium nitrate, soda, apatite concentrate and others) are not delivered into the storage for finished products, but are received by customers direct from the shops. In such cases the production is considered as finished if it is accepted by the technical control section and the marketing division of the plant.

If a chemical product is delivered from the shop storages, its delivery to such storages (made formal by receiving documents) is equal to delivery to the storage for finished products. Such a type of product includes sulfuric acid, superphosphate, etc.

2. The production of subsidiary and auxiliary shops, intended for outside delivery. For example, pulp and paper products, fumigants, etc.

3. Increase (decrease) in surplus of intermediates of the plant's own manufacture, intended both for outside delivery and for use at the enterprise.

Among the intermediates of a plant's own manufacture are products the technological process of which is completed in some shop of the plant, but which is subject, entirely or partially, to further processing in another shop of the plant, or is to be used in an assembly shop.

In the chemical industry the products of one and the same nomenclature may be either a finished product or an intermediate. Thus, if sulfuric acid manufactured at a chemical plant is used in a certain quantity in other shops of the plant for the manufacture of superphosphate and other chemical products, then it is an intermediate product; if, however, sulfuric acid, without being reprocessed in other shops of the plant, is delivered to an outside customer, then it is considered as a finished product of the plant.

4. Work of an industrial nature: capital repairs of equipment, packaging and bottling of products manufactured by other plants, etc.

Delivery to outside customers means not only delivery to other enterprises, but also delivery for capital construction, for capital repair of buildings and structures, communal economy and subsidiary agricultural enterprises of a given plant, and to other organizations of a non-industrial nature (day nurseries, educational institutions, etc.)

Example: Calculation of the gross production of a chemical plant.

According to the plan for 1960, manufacture is planned of sulfuric acid by Chamber process and of ordinary superphosphate. The major portion of the sulfuric acid is intended for reprocessing at the ordinary superphosphate shop. ([Note:] the figures are arbitrary.) Below is adduced a calculation of the gross production:

By multiplying the gross output by wholesale prices, the gross turnover is calculated. In order to obtain the gross production, the quantity of sulfuric acid used for the plant's needs, that is, for the manufacture of ordinary superphosphate, is deducted from the gross turnover (on the basis of 340 kg sulfuric acid to 1 ton ordinary superphosphate).

The most important division of the production program of an enterprise is a planned quota for the output of commodity production. That part of production of an enterprise which is intended for delivery outside of the enterprise is considered as commodity production.

The Commodity Production of an enterprise is planned according to current wholesale prices.

| Name of Product                          | Percent of active ingredient           | Gross output at cost, tons | Wholesale prices as of 1 July 1955 | Gross turnover, thous. rub.            |
|--|--|----------------------------|------------------------------------|--|
| Sulfuric acid                            | 100                                    | 122,000                    | 220                                | 26,840                                 |
| Ordinary super-phosphate                 | 18.7                                   | 300,000                    | 250                                | 75,000                                 |
| Total for the plant                      |  |                            |                                    | 101,840                                |
| Expenditures for own manufacturing needs |  |                            |                                    |  |
| At cost, tons                            | At wholesale prices as of 1 July, 1955 | Gross production           | At coast tons                      | At wholesale prices as of 1 July, 1955 |
| 102,000                                  | 22,440                                 | 20,000                     | 300,000                            | 75,000                                 |
|  |  |                            | -                                  | 79,400                                 |
|  |  |                            | 22,440                             |  |

If in the foregoing example of calculation of the gross production we assume that the remainder of the sulfuric acid in the amount of 20 thousand tons is intended for delivery outside, then the gross production will amount to commodity production (on condition that the wholesale prices as of 1 July 1955 will be effective in 1960).

If out of 20 thousand tons of sulfuric acid outside delivery is planned only in the amount of 15 thousand tons, then that is the amount of acid which is considered as commodity production.

In the tekhpromfinplan of enterprises it is necessary to provide for all possible improvement in the quality of the manufacture. For that purpose it is necessary to adhere strictly to the norms of the technological regime, and to use raw materials of the required quality.

## 5. The Plan for Material and Technical Supply.

The planned distribution of material resources is the most important part of planning in the national economy. The plan for the material and technical supply of an industrial enterprise is the leading part of the supply plan of the national economy.

The supply of materials for an enterprise for the year planned and the fulfillment of all the indicators of the tekhpromfinplan depend on the proper preparation of the plan for the technical and material supply.

Supply planning must satisfy the requirements of production in regard to quantity, quality, assortment, completeness and timeliness of the arrival of materials, as well as on their most economical utilization for their direct designated purpose.

Supply planning must provide for the building at enterprises of stocks of raw materials, supplies, fuel and intermediate products in sufficient, yet at the same time minimum, quantities.

One of the most important problems of supply planning is the assurance of minimum expenditures for the procurement and storage of materials, of a decrease or elimination of long-distance and cross-hauls or of obsolete methods of transportation.

The technical and material supply plan of an enterprise must take into consideration measures for the economy of materials in the process of manufacture and storage, for substitution of defective and expensive materials with less defective and cheaper ones, for utilization of locally available raw materials, supplies and fuel, as well as waste materials and other internal resources of the enterprise.

In preparation of a plan for the technical and material supply, and in the calculation of the industrial needs, it is necessary to establish a complete nomenclature of the required materials, their quality characteristics and the calendar time limits for their deliveries according to the production plan.

The calculation of demands for raw materials and basic supplies for the basic production shops, as well as for auxiliary and subsidiary shops, is made on the basis of the production plan (gross output data) and of established production expenditure norms.

The presence of definite stocks of materials at the plant warehouses is a required condition of the continuous function of production processes at an enterprise.

The quantity of supplies in storage must be kept to a minimum, because any superfluous supplies at enterprises create a strain on the material balance of the national economy and lead to a slowing up of the monetary circulation funds, increase in storage expenses and, consequently, financial difficulties for the enterprise.

On the basis of calculations of the materials and fuel demands and of the extent of required supplies for all types of raw materials, supplies, intermediates (from outside sources), fuel, packaging and all other auxiliary materials, material balances are compiled, wherein not only quantities, but also the supply sources of materials are indicated.

The total amount of materials which is to be received by a plant from outside during the period planned for is determined by adding up the data on the needs, and the planned stock of materials, for the end of the period planned for, and deducting from the sum obtained the surplus of materials at the beginning of the period planned for. Thus, for example, the requirement for pyrite for 1960 amounts to  $122,000 \times 0.8 = 97,600$  tons (122,000 is the gross output of sulfuric acid, 0.8 is the input factor of pyrite for one ton of acid).

For the end of 1960 the stock-pile of pyrite is planned in the amount of 4,000 tons (approximately a two weeks' supply). The surplus of pyrite at the plant warehouse by the beginning of 1960 is 7,000 tons. Hence, in 1960 the amount of pyrite to be procured is:  $97,600 + 4,000 - 7,000 = 94,600$  tons.

In compiling material balances in order to reduce hauling costs and decrease storage costs of the materials, it is necessary to provide for sources of supply close to the location of the enterprises.

In the program for the supply of materials for an enterprise, it is necessary to provide for obtaining them not only by way of a centralized supply, but also by way of decentralized purchases or laying-in of the enterprise's own stores. In order to meet the demands of the enterprise for materials by means of its own sources and mobilization of internal resources, production waste materials, spent materials after their regeneration, etc. may be used.

## 6. The Planning of Manpower and Wages

In planning manpower and wages at enterprises of the chemical industry it is necessary to provide for the growth of personnel productivity as compared to the level already attained, improvement in work scheduling, proper distribution of personnel according to their qualification, fullest utilization of work time, and improvements in the area of wage structure.

The plan of an enterprise should provide for the creation of such conditions as would assure the highest productivity on the part of every worker, introduction and wide application of achievements of leading workers and production experts, systematic finding and utilization of reserves for growth of labor productivity.

The manpower plan includes the entire personnel of an enterprise, which is divided into two groups:

a) the industrial and production personnel (promgruppa -- industrial group), and

b) the personnel of organizations of non-industrial character (nepromgruppa -- non-industrial group).

The first group includes workers of the main production shops, consumers' goods shops, auxiliary shops (repair, boiler), transport shops, subsidiary and auxiliary shops and manufactures (pulp and paper, peateries, coal mines, quarries, packaging shops), militarized, armed-guard, patrol and professional fire brigade, plant management structure with all of its divisions and bureaus, plant stocks of raw materials, supplies and finished products, as well as workers for cleaning of plant yards; workers operating plant showers and bathhouses designated only for the use by the personnel of the given enterprise, as well as workers of plant laundries for laundering and mending of work clothes; workers of the plant laboratories serving the production needs of the enterprise, and workers engaged in experimental and scientific-research work, design sections, and bureaus.

The second group includes workers of non-industrial organizations functioning within an industrial enterprise which are administratively and economically responsible to the director of the enterprise.

This personnel group includes workers paid from the funds of the given enterprise:

a) of the housing and communal services, (hostels, barber shops, bath houses servicing not only the personnel of the enterprise, laundries for general use, etc.);

b) of the cultural and welfare, and medical and sanitary services for the enterprise's personnel (children's day nurseries, clubs, dining-halls, dispensaries, first-aid stations, etc.);

c) of kindergartens and children's homes, and

d) administrative, economic, and teaching personnel of all types of educational institutions (schools, courses of studies, etc.).

established at the industrial enterprise. The non-industrial personnel group also includes workers engaged in major repairs of buildings and structures, subsidiary agricultural enterprises, and workers of temporarily closed shops.

Since the functions of the non-industrial personnel are not directly connected with the production work of an enterprise, such personnel is not taken into consideration in the determination of labor-productivity indicators.

Workers engaged in capital construction, even in cases where it is accomplished by the enterprise itself (with its own facilities) and is within the budget of the main activity, are not included in the personnel of the industrial enterprise, but are programmed separately, according to construction programs.

Depending on the nature of the functions performed, the entire industrial and production personnel is subdivided into the following categories:

- 1) Workers,
- 2) apprentices
- 3) engineering and technical personnel
- 4) employees
- 5) junior servicing personnel
- 6) militarized, armed-guard, patrol and professional fire brigade.

#### Planning of Labor-Productivity Growth

The most important division of the manpower plan is the plan for growth of labor productivity. In planning for the growth of labor productivity at enterprises of the chemical industry, the following factors are taken into consideration:

- 1) perfection of manufacturing processes, process automation, decrease of the length of production cycles;
- 2) mechanization (especially so-called lesser mechanization) of intensive manual labor;
- 3) efficient planning of the working day, unification and simplification of functions according to uniform or interconnected production places of work;
- 4) combining of skills and duties on the basis of advanced production experience;
- 5) better utilization of working time of the maintenance and other subsidiary-auxiliary workers through better performance of repairs, longer periods between repairs of equipment, decrease and elimination of non-productive work in superfluous transport and haulage of raw materials, supplies, fuel, etc.;
- 6) the application of the most rational shift schedules both in continuous process productions and in work not directly connected with the continuous production process (intermittent three-shift or two-shift work in auxiliary sections for feeding of raw materials, packing of finished articles, and at manufacturing sections where weekly shut-down is possible owing to conditions of the technological process, and where the capacity of the equipment assures fulfillment of the production program in a minimum number of shifts).

For individual shops manufacturing only one type of product the level of labor productivity may be determined by dividing the gross production output by the number of workers of a particular shop.

The output per one worker cannot be determined on the basis of the whole plant in natural units of measurement, but is calculated by dividing the gross production by the average number of workers of the industrial group.

If the gross production output of a plant is 79,400 rub. and the average number of workers on the payroll is 50, then the production for one worker on the payroll will be:

$$\frac{79,400}{50} = 1,588 \text{ rub.}$$

[Note: The number of workers in the industrial group is arbitrary: 34 persons in the sulfuric acid shop, and 16 persons in the super-phosphate shop].

The labor-productivity factor for one worker is also calculated.

#### Planning the Number of Personnel

Work performed by workers at chemical plants may be standardized or non-standardized.

The determination of the number of workers required for standardized work is based on the production program and on operational norms, production norms and time-standard norms established by technical-standardization methods.

For the determination of the required number of workers by shops, at section or division level, the calculation is performed according to the skills and scale rate category of workers.

Example. Determine the planned number of operators for a sulfuric acid shop, on the basis of established operational norms.

The production process is continuous.

For each place of work (worker's skill) the operational norms per shift are established as follows:

|                           |   |
|---------------------------|---|
| Senior Furnace Attendants | 1 |
| Furnace Attendants        | 3 |
| Upper Tower Attendants    | 1 |
| Lower Tower Attendants    | 1 |

The shift schedule of the shop is for four brigades, four workers to each work place.

Therefore, the permanent number of workers of the sulfuric acid shop is:

| Workers Skills | Operational Norm (number per shift) | Number of workers per 1 place of work by the schedule | Permanent number of workers |
|----------------|-------------------------------------|---|-----------------------------|
|----------------|-------------------------------------|---|-----------------------------|

|                           |   |   |   |
|---------------------------|---|---|---|
| Senior Furnace Attendants | 1 | 4 | 4 |
|---------------------------|---|---|---|

|                           |   |   |    |
|---------------------------|---|---|----|
| Furnace<br>Attendants     | 3 | 4 | 12 |
| Upper Tower<br>Attendants | 1 | 4 | 4  |
| Lower Tower<br>Attendants | 1 | 4 | 4  |
| Total for<br>the shop     | 6 |   | 24 |

The payroll number of operators of the sulfuric acid shop is determined by adding to the permanent number of workers those that are required to replace the workers absent due to vacations, civic or State duties and illnesses.

The supplementary number of workers depends mainly on the length of time off. If workers in a sulfuric acid shop have a time-off period of 24 days, the supplementary number of workers to replace those on vacation and absent for other causes may amount to approximately 10%. In our example it would be two workers. Therefore, the payroll number of workers of the sulfuric acid shop would, according to the plan, be 26 workers.

In the intermittent production processes, for the determination of the budgeted number of operators it is necessary first of all to establish the number of work shifts for the period planned. This is done on the basis of the production program, the technical and production norm established for the shift, and the proposed operating regime.

Example: Determine the regular number of workers of a superphosphate shpp on the basis of the following data

([Note:] the figures are arbitrary.)

The production process is intermittent, no work being performed during days-off or holidays.

The production quota for the first quarter is 85,000 tons, for the second quarter 115,000 tons.

The technological production norm for one shift is assumed as 500 tons.

Operating norms per shift:

Pan mixer operator 1

Unloaders 2

In the first quarter the number of shifts is:

$$\frac{85,000}{500} = 170$$

With 77 calendar working days in the first quarter, the proposed shift schedule is:

$$\frac{170}{77} = 2.2$$

Therefore, for the first quarter it is advisable to plan two-shift intermittent work with a total number of shifts:

$$77 \times 2 = 154$$

In this case the fulfillment of the production quota will be assured by overfulfillment of the technical production norm per shift by 10%:

$$\frac{85,000}{154} = 552 \text{ tons}$$

In the second quarter the number of shifts is:

$$\frac{115,000}{500} = 230$$

With 76 calendar working days in the second quarter, the proposed shift scheduling is:

$$\frac{230}{76} = 3.03$$

Therefore, for the first [Translator's note: probably a misprint in the Russian text -- should be "for the second"] quarter three-shift intermittent work should be planned.

On the basis of the data obtained, the permanent number of operators for the superphosphate shop is determined:

| Workers' skills           | I quarter        |                  |                             | II quarter       |                  |                             |
|---------------------------|------------------|------------------|-----------------------------|------------------|------------------|-----------------------------|
|                           | Operational norm | Number of shifts | Permanent number of workers | Operational norm | Number of shifts | Permanent number of workers |
| Pan mixer operators       | 1                | 2                | 2                           | 1                | 3                | 3                           |
| Unloaders                 | 2                | 2                | 4                           | 2                | 3                | 6                           |
| <b>Total for the shop</b> | <b>3</b>         | <b>2</b>         | <b>6</b>                    | <b>3</b>         | <b>3</b>         | <b>9</b>                    |

The permanent number of workers for the III and IV quarters is calculated in the same manner.

If in the III quarter such a number should arbitrarily be eight people and in the IV quarter -- 10, then the average yearly permanent number will be approximately 8.5 persons.

The additional number of workers required for substitution of temporarily absent ones in connection with planned days off is established as described above, and is approximately 1.5 persons.

Therefore, the average payroll number of workers in the super-phosphate shop is 10 persons.

The number and personnel of the engineering and technical staff is planned in accordance with the management structure of the enterprise and of the shops.

On the basis of the established management scheme, a permanent staff schedule is compiled, according to which the duties of the engineering and technical personnel, their number and their salaries are indicated for each structural subdivision.

In the compilation of the tekhpromfinplan it is necessary to take into consideration the introduction of industrial engineering measures direct toward reducing the size and cost of the management apparatus of the plant and shops by simplifying the management structure, mechanization of records and planning, combining of a number of duties, and efficient planning of the working day for the engineering and technical personnel.

#### Wage Planning

The planning of wages at an enterprise should stimulate the

growth of labor productivity, raising of the workers' qualifications and promoting labor discipline on the basis of definite industrial engineering measures. In planning the measures it is necessary to provide for:

- a) the isolation, according to wages, of the most essential and complex manufactures, sections, and skills, and the elimination of unwarranted overpayments in the case of individual occupations and skills;
- b) the elimination of improper and ineffective systems of premium payments, or revision of obsolete premium systems.

The planned workers' wage fund is determined on the basis of a wage fund schedule, that is, of the wages payable according to wage scales.

Example: Calculate the wage fund schedule:

According to the plan the regular number of operators of the V category in a sulfuric acid production is 12 persons, the shift schedule is for four brigades; the hourly wage rate for the V category is 4 rub. 91 kop. Working time expenditures (in man-hours) according to the plan are [Note: the calendar fund equals to 365 days in a year, the number of the days off with a four-brigade schedule and a seven-hour working day -- to 91 days; hence the number of working days equals to  $365 - 91 = 274$ . The length of a shift is eight hours.]

$$274 \times 12 \times 8 = 26,304$$

The wage fund schedule is

$$4.91 \times 26,304 = 129,153 \text{ rub.}$$

If in the plan there is outlined an overfulfillment of the established output norms, then in the planned wage fund it is necessary to provide for supplementary piece-work wage, according to the schedule.

The supplementary piece-work wage is calculated on the basis of production wages for work over and above the norm, according to straight piece-work rates.

In planning overfulfillment of norms by 10%, the additional piece-work wages will be:

$$129,153 \frac{10}{100} = 12,915 \text{ rub.}$$

The wage fund also includes additional pay for night work and work during non-working days (holidays), vacation pay, payments for time spent on performance of State and civic duties, as well as premiums for achievement of quality and quantity indicators.

On the basis of the planned wage fund and number of personnel, the average wages are computed.

With a planned fund, for example, of the wages of all workers of a sulfuric acid shop amounting to 260 thousand rub. and a payroll number of 26 workers, the average yearly earnings will be equal to:

$$\frac{260,000}{26} = 10,000 \text{ rub.}$$

## 7. Production Cost Plan

The production cost plan determines expenditures required for manufacture of the planned volume and variety of industrial production.

The establishment of the planned quota of production cost is one of the basic problems of plant planning.

The most important aim of the production cost plan is the finding of internal reserves, finding and mobilization of every means for lowering the production cost.

The most important problems in production cost planning at enterprises are:

- 1) determination of the planned production cost of individual types of manufacture by compiling planned cost estimates, and

- 2) calculation of lowered production cost for the plant as a whole.

In compiling cost estimates the following are determined consecutively:

- 1) shop prime cost;
- 2) plant prime cost;
- 3) complete (trade) cost;

The shop prime cost consists of all expense items (see below) including shop expenses.

In order to obtain the prime plant cost, the general plant expenses are added to the shop cost.

The complete (trade) cost is determined by adding the non-production expenses to the plant prime cost.

The planned cost estimates, as the accounting ones, are compiled from the following expense items:

- 1) Raw materials and basic supplies.
- 2) Technological fuels.
- 3) Power expenditures (electric power, steam, water).
- 4) Production workers' wages.
- 5) Amortization.
- 6) Shop expenses.
- 7) General plant expenses.
- 8) Non-production expenses.

The expenditure of raw materials, supplies, fuels and power for a unit of production is shown in the cost estimates in the natural and cost price expression.

The cost estimate item entitled "Raw Materials and Basic Supplies" includes materials directly entering into chemical reactions. For example, pyrite in the production of sulfuric acid, apatite concentrate in superphosphate production, etc.

In planned cost estimates raw materials and basic supplies are calculated according to estimated purchase prices added up from the suppliers' prices and procurement expenses.

Fuel used for technological purposes (steaming, melting, burning) is shown in the cost estimate as a separate item.

The cost estimate item "Wages of production workers" includes the wages of workers engaged directly in the performance of production processes. In the production of sulfuric acid, production workers include furnace and tower operators and others. This expense item also includes deductions for the social insurance fund. In the chemical industry all enterprises deduct 8.4% from the wage fund for social insurance fund.

Amortization expenses are also included in the cost estimates.

Equipment, buildings, structures, which are referred to as basic assets (facilities) after functioning for extensive periods of time and in the course of the production process gradually depreciate. A definite portion of the cost of equipment, buildings

and structures is included annually in the production cost, and is designated as amortization.

Example: Calculation of amortization expenses [Note: Figures are arbitrary].

The main assets of a sulfuric acid shop: equipment -- 1,000 thousand rub., building -- 300 thousand rub. Equipment amortization rate -- 8.9%, building -- 2.7% of the value of the main assets.

On the basis of the above data, the amount of amortization (in thousand of rub.) is

8.9% of 1,000 thousand rub. = 89

2.7% of 300 thousand rub. = 8.1

Shop expenses, that is, expenses for management and operation of shops, are included into the budget cost estimate on the basis of preliminary estimates.

An estimate of shop expenses is made on the basis of a calculation of expenses for each item of the estimate. Shop expenses consist of the following main items: maintenance of the shop personnel, maintenance of the shop buildings and structures, current repairs of the main shop facilities, equipment maintenance, freight transport, labor protection, maintenance of the shop laboratory and improvement expenses.

The item of shop expenses for the maintenance of shop personnel includes the wages of the shop director, technical supervisor of the shop, and other engineering and technical personnel, employees (accountant, bookkeeper), junior service personnel, as well as workers of the shop laboratories and OTK (otdelenie tekhnicheskogo kontrolya -- section of technical control) and workers of the shop warehouses and storehouses, engaged in the work of receiving, delivering, dismantling, and sorting of materials, instruments, and intermediate products.

The wages of the rest of the shop workers, with the exception of the wages of production workers, are entered into the corresponding items of shop expenses, respectively.

For the compilation of the estimate of shop expenses, the data on workers' wages are taken from the corresponding section of the labor plan.

Expenses for the maintenance of buildings and structures include expenditures for the heating and lighting of shop premises, as well as for maintaining the shop premises in a clean condition.

The item of "Equipment upkeep" includes all expenses connected with the maintenance of equipment in working condition and its upkeep (wages for personnel on duty, lubricating and wiping supplies, etc.)

Expenses for current maintenance include expenses related to preservation of basic facilities of the shop in operating condition by timely and regular repairs.

The above item includes shop expenses for services in connection with current repair work of other shops -- of the mechanical shop, the electrical shop, and other service departments.

The item of "Freight transport" includes expenses for delivery of raw materials, supplies, intermediates, fuel, auxiliary supplies and packaging materials from plant warehouses to shop; for transport of waste and finished products to the warehouse, maintenance of shop transport facilities, and payment for services of the plant transport shop.

Expenses for the maintenance of the shop laboratory consist of the expenditure of chemical reagents and laboratory glassware (the wages of the laboratory personnel are included in the item "Shop Personnel Maintenance").

Improvement expenses include remuneration of inventors and of the authors of technical developments and improvement suggestions, organization of tests for such suggestions, etc.

Shop expenses for labor protection include expenses for special work clothes, milk, special nutrition, etc., as well as expenses for the adoption of measures for technical safety, production sanitation, ventilation, education in technical safety and industrial health, physical culture, maintenance of showers, baths, etc.

On the basis of the general plant and shop expenses, an estimate is prepared. The estimate is calculated for each group of the general plant expenses: administrative and economical expenses, general operating expenses, collections and deductions.

The administrative and economical expenses are those for administration of the enterprise (salaries of workers in plant management, travel expenses, office, postal and telegraph expenses, etc.)

General operating expenses include upkeep of all plant buildings, structures, warehouses, laboratories, design offices, data processing machine stations, and other operational expenses of general plant nature: security force of the enterprise, training of personnel, organized recruitment of manpower, etc.

In the "Collections and deductions" group, the tekhpromfinplan provides for local taxes and collections -- assessment tax on structures and ground-rent, levied by municipal Soviets of Working people's deputies, and in small towns and villages - by the rayon Soviets of working people's deputies.

Taxes on structures are assessed on factory and plant buildings, warehouses, trade premises and all kinds of other structures

(including service structures) belonging to the enterprises,  
([Note: According to the law adopted by the Verkhovnyy Sovet USSR --  
Supreme Council of the USSR), enterprises have been released from  
payment of taxes on structures and from the ground-rent.]

To obtain the complete (trade) production cost, one should add the non-production (trade) expenses to the plant production cost.

The tekhpromfinplans of chemical plants must provide for non-production (trade) expenses in connection with the sales of the product and deductions for the support of scientific-research institutes and sovnarkhoz branch administrations.

In the preparation of shop, general plant, and non-production estimates, it is necessary, on the basis of strict organizational and technical measures, to make a provision for a maximum reduction of expenses on the part of an enterprise.

The calculation of lowering of production cost for the plant is carried out in the following manner (see Table, page 234a).

The budgeted cost of a unit of production is determined from the budgeted cost estimates.

The final cost for the preceding year is determined on the basis of the summarized cost estimates for the year. In compiling the plan prior to the beginning of the budget year, it is necessary to calculate for each product (article) the expected production cost for the current year.

The summarized production cost for the preceding year or the expected production cost for the same period is the basic production cost to which the budgeted production cost is compared for the purpose of determination of the expected change in the cost.

| Type of products                      | Planned production of goods tons         |                  |                  | Change in production cost |                  |       |
|---------------------------------------|--|------------------|------------------|---------------------------|------------------|-------|
|                                       | 1959 report                              | 1960 Plan        | 1959             | 1960 Plan                 | 1960 Plan        | 1959  |
| Full production cost per one ton rub. | Production of goods of 1960 plan at cost | in thousand rub. | in thousand rub. | in thousand rub.          | in thousand rub. | in %  |
| Sulfuric acid                         | 20,000                                   | 195              | 190              | 3,900                     | 3,800            | 100   |
| Ordinary super-phosphate              | 300,000                                  | 220              | 200              | 66,000                    | 60,000           | 6,000 |
| Total for the plant                   |  |                  |                  | 69,000                    | 63,800           | 6,100 |
|                                       |  |                  |                  |                           |                  | 8.7   |

Calculation of the lowering of production cost for the plant as a whole is carried out only on the basis of comparable products, that is such products as had been manufactured in the preceding year.

If no products were manufactured in the preceding year, and are only planned for production in the budget year, then they are considered as non-comparable production. Thus, if it is planned to produce granular superphosphate in the year 1960, which was not produced in 1959, being non-comparable production, it is not included in the calculations for the reduction of production cost for the plant.

Beginning with 1958, instead of a quota for the reduction of manufacturing cost of comparable goods, quotas are established in the form of expenditure levels to one ruble of goods manufacture at wholesale prices of the enterprise (before taxes).

Expenditure for one ruble of production of goods is the ratio of the volume of goods production at cost to the same volume of goods production at wholesale prices.

#### 8. Financial Plan

The financial plan reflects the circulation of the enterprise's own assets (all the income and expenses), as well as the means received from senior organizations and from the State budget.

The assets of an enterprise are subdivided into the capital (principal) and current assets. The capital assets include equipment, buildings, structures, instruments (tools), transport facilities and inventory. The current assets comprise stocks of raw materials and supplies, low-value and short-life expentancy articles, expenditures on uncompleted production, the surplus of finished products and consignment goods, balance of future-period expenditures, balance of monies and assets available in the enterprise accounts with suppliers and customers.

Current assets are expended for acquisition of supplies, fuel, payment for electric power and steam obtained from outside sources, payment for services of other organizations, personnel, and other expenses connected with production activity. Upon the sale of the finished product these assets are returned to the enterprise.

In their continuous turnover, current assets pass through three stages.

In the first stage, the current assets assume the form of stocks of raw materials, fuel, and other supplies intended for the production.

In the second stage the current assets take part in the process of production manufacture in the form of intermediate products.

In the third stage, the current assets function consecutively in the form of finished products, delivered goods, and monetary funds.

In order to assure the continuous production process of industrial manufacture, every enterprise should have at its disposal adequate, but minimum, current assets in all three stages simultaneously.

Depending on their source of origin, the current assets of an industrial enterprise are divided into its own and those borrowed.

Industrial enterprise's own current funds are appropriated by the Government for permanent use to provide for a minimum stock of raw materials, fuel, intermediates, finished products and various supplies required for the fulfillment of the production program.

Any additional demands for the current fund of an enterprise are met by short-term credits from the State Bank.

The current funds obtained by an enterprise in the form of bank loans are referred to as borrowed revolving funds.

Borrowed revolving funds are obtained by enterprises for limited periods of time to provide for temporary needs (supplies, marketing of products, consignment goods, etc.)

A portion of the revolving funds must be maintained by the enterprise in the form of cash (for payment for delivered supplies, payment of wages, and salaries, etc); only on this condition is normal circulation of the funds of the enterprise possible.

The enterprise's own revolving fund is accumulated in the form of monies in the budget accounts of the enterprise as the stock of supplies is used up, the products manufactured, and the sales consummated.

Wages are paid for time worked. As a result, an accumulation of free monies occurs in the budget accounts.

At the time the tekhpromfinplan is approved, a definite amount of its own revolving fund is allotted to each enterprise for the entire current budget year and for each quarter.

With the growth of the production program, an enterprise's need for its own revolving fund increases.

Financing of the increase of an enterprise's own revolving fund is carried out at the expense of that enterprise's income, that is, the replacement of the capital of an enterprise is in direct dependence on the fulfillment of its plan for the accumulation of capital.

If the income budgeted in the plan is inadequate, then the funds of senior organizations and budget capital form the sources which fill the needs of an enterprise's own revolving fund.

Correct determination of the demands of an industrial enterprise for its own operating fund is of great significance. Underestimation of the actual needs of an enterprise for such funds may cause interruptions in the fulfillment of the production program, as well as financial difficulties (delays in payment of wages, late payments to suppliers of raw materials and supplies, etc.) On the other hand, oversaturation of the actual needs of an enterprise

with revolving funds constitutes unproductive use of resources of the national economy and lowers the desire of the enterprise to improve its financial indicators.

An enterprise's demands for its own current capital are determined on the basis of preliminarily established standards for the needed commodity values.

Standards for raw materials and supplies are established in such a way that the enterprise would have its own current capital from the instant it pays the suppliers' bills for materials delivered, until the time of their entry into production.

Standards for incompletely produced products are determined on the basis of production volume, period of production cycle and manufacturing cost of the incomplete production. The period of the production cycle is computed from the instant of entry of the materials into production until receipt of finished product and its acceptance. The longer the production cycle, the greater, other conditions being equal, is the surplus of incompletely produced products.

The standards for finished production must provide an enterprise with its own current capital from the time of the entry of the finished products into the plant warehouses of the marketing division until the documents are presented to the bank. Upon presentation of the documents to the bank, the enterprise obtains credit loans.

Standards for finished production depends on the duration of its storage at the plant warehouses (if it is intended for delivery to the finished-product storage), and also on time spent on the loading, weighing, transportation of the products from the plant warehouses to the railway station, preparation of shipping documents and presentation of the documents to the bank.

The tabulation of the standards for the revolving assets should be based on the maximum possible speed-up of its turnover; the faster the turnover of the revolving assets, the less are they needed by the enterprise.

The turnover capacity is expressed by the number of turnovers in the course of a year or by the time taken by a single turnover (in days).

Example: According to plan, the plant must sell products in the amount of 100 million rub; the revolving assets are budgeted in the amount of 20 million rub. Hence:

Number of turnovers

$$\frac{100}{20} = 5$$

Period of a single turnover

$$\frac{360}{5} = 72 \text{ days.}$$

The tekhpromfinplan of an enterprise must outline definite measures for the speed-up of the turnover capacity of the revolving assets.

The principal way to speed up the turnover capacity of current assets in an area of production consists of shortening the production cycle, reducing the stocks or supplies and reducing the amounts of uncompleted production.

Developments in production technology, mechanization of labor intensive work, changeover to flow production methods -- all these reduce significantly the period of the production cycle.

Speeding-up of the turnover capacity of the assets is achieved also by reducing the stocks of supplies and fuel.

In order to speed up the turnover capacity of the current assets, it is necessary to speed up the delivery of finished products to consumers. This not only expedites the turnover capacity of the assets, but also reduces storage expenses for products at the plant's warehouses.

The plan for accumulations constitutes an important division of the financial plan.

In the USSR the finished products of industrial enterprises intended for sale (consumers' use), are sold at prices established by the Government.

The income from the production sale, less the production cost, constitutes the profits of an enterprise. The lower the production cost, the higher is the profit at a given price level. If the production cost exceeds the prices approved for that production, then the enterprise is unprofitable. The ratio of the profit to the production cost, expressed in percentages, is called the earning capacity of a product.

The manufacturing cost of products of the chemical industry having the same nomenclature may vary. Thus, for example, the manufacturing cost of one ton of sulfuric acid may be 170-180 rub. at some plants, and 250-260 rub. and higher at other plants. The difference in the production cost of sulfuric acid is explained as follows. Some plants work with cheap raw materials (waste gases of non-ferrous metals), others -- with more expensive raw materials (pyrite); the output volume of acid varies at different plants (at small sulfuric acid plants the production cost of the acid is higher. The level of the production cost is also affected by some internal factors. With the same production scale and similar raw materials, the cost of sulfuric acid is higher at some plants than at others due to imperfect work and production scheduling, application of obsolete technology, etc.

Identical prices are established for production of the same nomenclature (independent of its production cost at different plants).

Identical prices are usually established for products at the level of average cost, and plants manufacturing products at a cost which is below average are paying concerns, whereas plants manufacturing products at a cost above average are unprofitable.

Example: Calculation of the budgeted profit of a chemical plant.

The price of sulfuric acid is 220 rub. per ton; the price of ordinary superphosphate is 250 rub. per ton [Note: the prices are arbitrary. Wholesale prices of chemical products are quoted in the Price List of wholesale prices of the Ministry of the Chemical Industry). According to the plan, the cost of sulfuric acid is 190 rub., and that of ordinary superphosphate -- 200 rub. per ton.

The profit is calculated in the following manner:

| Types of production according to plan | Production of goods | Wholesale prices rub. | Estimated cost rub. | Production of goods (thou. rub.) | Profit (thou. rub.) |                     |
|---------------------------------------|---------------------|-----------------------|---------------------|----------------------------------|---------------------|---------------------|
|                                       |                     |                       |                     |                                  | at wholesale        | At sale Cost prices |
| Sulfuric acid                         | 20,000              | 220                   | 190                 | 4,400                            | 3,800               | 600                 |
| Ordinary super-phosphate              | 300,000             | 250                   | 200                 | 75,000                           | 60,000              | 15,000              |
| Total for the plant                   | -                   | -                     | -                   | 79,400                           | 63,800              | 15,600              |

Hence, the earning capacity of the plant amounts to:

$$\frac{15,600}{63,800} \cdot 100 = 24.5\%$$

A portion of the profit remains at the enterprise and is spent on individual premiums and on improvement of the cultural and welfare needs of enterprise workers. The amount of profit left at the director's disposal depends on the results of the performance of the enterprise towards the fulfillment of the State plan.

From the profits special funds are formed which are important in the matter of material encouragement of the workers of the enterprise. Premiums from these funds are paid over and above the premiums from the wage fund.

The special funds formed from the profits include:

- 1) the fund of the enterprise,
- 2) the fund of profits from the production and sale of consumer goods manufactured from waste products,
- 3) the premium fund from the results of socialist competition of the enterprises.

Another portion of the profits enters into the State budget income and is spent on the financing of capital building construction of that particular, as well as other, enterprises of the chemical industry by way of intra-industrial redistribution. The third portion of the profit is intended for financing the increase of an enterprise's own current funds and for the financing of the increase of the current funds of other chemical enterprises by way of intra-industrial redistribution of the assets.

Problems (Note:] The figures are arbitrary.)

- 1) According to the 1960 plan, a gross output of 200,000 tons of sulfuric acid, 400,000 tons of ordinary superphosphate, and 200,000 tons of granular superphosphate is contemplated. The proposed ratio of sulfuric acid for one ton of superphosphate is 0.35, the proposed ratio of ordinary superphosphate for one ton of granular superphosphate is 1.01. From the total gross output of sulfuric acid, 20,000 tons are intended for outside deliveries.

Calculate the gross and commodity output of the plant.

- 2) The gross output of a plant according to the budget is 250,000 thousand rub. The payroll number of workers in the industrial group is 150. The plan for the next year provides for an increase of 20% in the production volume and of 10% in the payroll number of workers, as compared to the current figures.

Determine the increase in labor productivity of the plant according to the plan for the next year.

3) According to the yearly plan the gross output of sulfuric acid is 100,000 tons, of ordinary superphosphate -- 200,000 tons and granular superphosphate 80,000 tons, including 20,000 tons of commercial grade ordinary superphosphate.

The estimated cost of one ton of sulfuric acid is 200 rub., of ordinary superphosphate -- 160 rub. and of granular superphosphate -- 220 rub.

According to final estimates the cost of one ton of sulfuric acid is 210 rub. and of ordinary superphosphate -- 175 rub.

No granular superphosphate was manufactured in the preceding year.

Determine the reduction in cost according to the plan for the year for the entire plant.

## Chapter Nine

### SOCIALIST COMPETITION AND ITS ROLE IN RAISING LABOR PRODUCTIVITY

#### 1. Main Stage in the Development of Socialist Competition

Socialist competition has enormous significance in promoting the increase of labor productivity and production development.

In the course of competition, the inner reserves of enterprises are more fully revealed, technology and production administration developed, labor productivity is raised, production cost decreased, and the quality of production improved. Socialist competition promotes the fulfillment and overfulfillment of production plans and increasing growth of socialist production, as well as wide propagation of progressive methods.

The main principle of socialist competition is comradely assistance rendered by leading workers to those who lag behind, for the purpose of achieving a general upsurge of labor activity.

Socialist competition in the USSR has traveled the road from the first communist subbotniki (labor freely given to the State on off-days or overtime) of the civil war period to nationwide socialist competition.

The communist subbotniki were the first signs of a new, communistic outlook on labor, and laid the foundation for the wide-

spread development of socialist competition.

The first communist subbotniki was carried out in Moscow on 10 May 1919, on the Moscow-Kazan railway.

Ya. Kondrat'yev, one of the organizers and participants of the first communist subbotnik at Sortirovochnaya depot, and former locomotive engineer of that depot, reminisces (see Socialist Labor, No 11 1957): "On 24 March 1919, on the eve of the religious holiday of Annunciation, work was stopped earlier than usual, at 2 o'clock in the afternoon, and workers were leaving for home.

"Just then two troup trains arrived at Sortirovochnaya station, carrying workers from Moscow and Petrograd to the Eastern front, against Kolchak. No engines in good repair were available, nothing to pull the troup trains. What was to be done? An emergency party meeting was called, which was attended by 13 communists and two sympathisers.

"Realization of the danger threatening our country and the desire to help the front lines excited us, and then and there we reached the firm decision: not to go home until we ourselves deliver the locomotives now being repaired for the troup trains. That day our first subbotnik took place.

"We worked with unprecedented enthusiasm, encouraging one another. All went well, non complaining of weariness or hunger. The brigades tried to outdo one another, and those who had completed their assignment helped other comrades.

"Never had work been so inspired and joyous, never had it gone so smoothly, as in that well-remembered night in March. Repairs of the engines were carried on until morning. In the morning, the foreman, a non-party man, upon thorough inspection of the repaired locomotives, said that if everyone would work as did the communists, we would be delivering locomotives for the trains without any interruptions."

On 7 May a meeting was held by the communists of the podrayon (sub-district) of the Moscow-Kazan railway. After the report of the subbotniki taking place at Sortirovochnaya depot, the decision was adopted to work six hours every Saturday until a final victory over Kolchak.

On Saturday 10 May at six o'clock in the evening the first mass communistic subbotnik was held at the Moscow junction of the Kazan railway, 205 people participating. Four train locomotives, 16 cars were repaired, 9,300 poods of various freights and supplies were loaded and unloaded.

Thus the first communistic subbotniki were born.

The Soviet Government evaluated very highly the services of the workers -- initiators of the first communistic subbotnik, and awarded the depot the Order of the Red Banner of Labor.

Having been originated during the civil war years, socialist competition, directed by the Communist Party, developed as a mass movement especially in the years of socialist industrialization of the country, in the years of the first Five-Year Plans, becoming a common cause of the nation.

In March 1929 a brigade of foundry cleaners of the Leningrad "Krasnyy Vyborzhets" Plant was the first in the USSR to sign an agreement for socialist competition! The workers of that plant appealed by letter to the collectives of all plants and factories in the country, challenging them to socialist competition.

The Communist Party organized and inspired this upsurge of labor activity of the Soviet people in every stage of socialist building. In April 1929 the XVI party conference, having passed the first Five-Year Plan, appealed to all workers and working peasants of the Soviet Union to organize socialist competition for successful fulfillment of the first Five-Year Plan.

The adoption of new technology in all branches of the national economy, elevation of the cultural and technical standards of workers and improvement of their material welfare, promoted the origination in 1935 of the Stakhanov movement, which formed a new stage of development in socialist competition in industry.

The Stakhanov movement opened up wide possibilities for fast growth and development of socialist production on the basis of adoption and full utilization of new technology.

During the post-war years, socialist competition achieved ever wider range. Over 90% of the working people of our country are participating in socialist competition. Production experts, by proper scheduling of labor, economize on work time, and on that basis increase the production output, overfulfill production quotas, improve their work and pass on their experience to other workers.

In 1951 the Central Committee of the Party and the Council of Ministers of the USSR adopted a resolution to improve the administration of socialist competition. The Party and the Government, pointing out the enormous significance of competition as a powerful means of mobilizing workers in the effort to fulfill the plan, demanded that the party and trade-union organizations, and economic directors assure a further upsurge of socialist competition and eliminate shortcomings in competition leadership.

After the decision of the Central Committee of the Party and of the Council of Ministers, socialist competition was developed further. The XII Congress of trade unions pointed out in their resolutions that trade unions had performed considerable work

in the development of socialist competition. The administration of the competition of enterprise collectives in most branches of the national economy was transferred to the local level, becoming as a result more defined and operative. However, shortcomings, formalism and bureaucracy had not yet been eliminated in this live and creative cause.

Some certain Soviets and trade-union committees, -- as pointed out by the XII Congress of trade unions -- do not show sufficient care in seeing that competition is actually on a mass level, purposeful and well defined; that all workers, engineers and technical personnel participate therein, and that each worker has his own definite obligations. The results of competitions, at individual enterprises, are not summed up regularly, not always discussed at meetings of workers and other employees, and not always given sufficient publicity in the press. In announcing the winners of competitions, trade union organizations and economic leaders do not always pay sufficient attention to those collectives and individual workers who are lagging behind, taking no measures to bring them up to the level of the peredoviks.

The Central Committee of the Communist Party, in its opening address to the XII Congress of Soviet trade unions, pointed out that the most important, most essential problem before Soviet trade unions at present is to mobilize the efforts of wide masses of working people in striving toward the fulfillment of the historic decisions of the XXI Congress of the Party, and fulfillment of the Seven-Year Plan ahead of schedule.

As shown by the experience of many years, the most widespread and active form of organization of competition at enterprises is that of individual and brigade competition. In such competition the creative initiative of the competitors is most fully manifested. The course and results of a competition must systematically be discussed at meetings of the workers and other employees, and widely publicized at production conferences through newspapers with a wide circulation and through wall newspapers, as well as by means of the plant radio broadcasting system. Indicators of fulfillment by workers of production norms or quotas should be posted daily at each production section.

Socialist competition should not be bounded within any frames, because in it is revealed the individual activity and creative initiative of the masses. All formalism in socialist competition must be actively eliminated.

The main indicators in socialist competition of workers should be: overfulfillment of production norms, mastering of advanced labor methods, improvement of production quality, saving of raw materials and supplies, lowering of the unit cost of production, etc.

The results are summed up from the competition indicators. The winners of a competition, by profession or skill, over a period of three consecutive months are awarded the title of best worker in a given skill. The names of competition winners who retain such a title for six months running are placed on Boards of Honor and they are awarded merit certificates, and the names of those who retain the title for over a year are entered into the Book of Honor, with presentation of certificates.

The winning of the title of best worker in his own skill, the entry of a name onto the Board of Honor or into the Book of Honor, and awarding of the honorary certificate must take place at conferences of plant and factory committees with participation of the directors of enterprises, while discussion of the results of a competition and presentation of awards and incentives must be held at general meetings.

The development of socialist competition at enterprises is a continuous aim of the shift supervisors and foremen. They should help all workers assume definite socialist obligations.

In the course of a competition, new, progressive forms and methods of labor, and innovations promoting a further upsurge of labor productivity, are daily born and rapidly become available to everyone.

#### Competition for the Economy of Raw Materials and Supplies.

At enterprises of the chemical industry, operators of the Dorogomilovskiy chemical plant, I. I. Samoylov and I. F. Karpukhin, were the initiators of socialist competition for the increase of production output and better use of raw materials.

Having studied the technological process, and combining their accumulated experience, they discovered reserves in the established technological process for a further increase of high quality production output with the same equipment, without additional expenses for raw materials.

I. I. Samoylov was operating autoclaves in the production of Captax. Carrying out the technological process according to regulation, maintaining the temperature within the limits of 265°-280° and the pressure at 65-75 atm., samoylov became convinced that the highest yield was obtained when the process was carried out at a temperature near 280°, and with a pressure of 74-75 atm. The output of production in such a case is increased owing to a more complete utilization of substances taking part in the reaction, and to a decrease of losses.

Operating in such a manner, samoylov increased the production output by 2.7%, saved a considerable amount of aniline, nitrobenzene, and other chemical products.

I. F. Karpukhin, working on the production of thiuram, according to the technological regulations had to load the raw material in the autoclave at a temperature of not above 35°. Operator Karpukhin established that it was more advisable to load the raw material at a temperature of 22°, since with a higher temperature the raw material, due to its volatility, evaporated more rapidly, and losses were increased. By carefully regulating the temperature while loading the raw material, Karpukhin increased the production output by 1.0%.

A considerable part in the discovery of reserves for the increase of production output without additional expenditure of raw materials was played by the work experience of production expert P. I. Krivosheykin, senior furnace operator of a sulfuric acid shop at the Voskresenskiy chemical kombinat.

P. I. Krivosheykin, with his assistant, was operating seven furnaces of the VKhZ (Voskresenskiy Khimicheskiy Zavod -- Voskresenskiy Chemical Plant) type, wherein pyrite is roasted for obtaining sulfur dioxide.

Having studied the technological process and the methods of regulating the equipment, Krivosheykin, on the basis of many-years' experience, developed methods of servicing the furnaces which permitted the achievement of high output.

In order to decrease losses of sulfur contained in pyrite cinders and increase the operating efficiency of the furnaces, Krivosheykin did not permit any crust to form on the crowns of the furnaces. For that purpose, daily, after assuming his shift, he cleaned the troughs opposite the door in the burning layer of pyrite and, shaking the passing rotating arm with a special bar, pressed it back. As a result, the rotating arms settled lower, the teeth approached the bottom of the furnace, and the forming crust was easily loosened by the teeth. At the same time the sulfur content in the pyrite cinders was decreased, because the crust was well loosened and the sulfur burned out completely.

For the purpose of decreasing losses of sulfur caused by slag formation of the pyrite on the hot crowns, Krivosheykin regulated the supply of air; supplying the air to the third and fourth crowns of the furnaces, he lowered the temperature and avoided the caking of pyrite. If any signs of slag formation did appear, and the rotating arm began to "drag", Krivosheykin broke up the slag forming pyrite, without pushing it into the lower hearth, but leaving it in the same hearth in order not to shorten the passage of the pyrite through the furnace and to assure a more complete burning of the sulfur. While so doing, Krivosheykin began stirring away from the shaft, completing this at the end of the rotating arm, which enabled him to carry out the stirring during one quarter turn of the shaft.

P. I. Krivosheykin paid particular attention to regularity in loading the furnace, the supply of pyrite depending on its quality. He watched the controls of the process instrumentation constantly, regulating the air supply and the draft, at the same time cleaning and replacing the worn-out teeth of the rotating arm.

P. I. Krivosheykin maintained the equipment of the furnaces in excellent condition and took care to keep it in good operating order.

When assuming his shift, he and his assistant thoroughly inspected the furnaces, and upon discovering any violations in the technological regime, immediately took steps to correct them.

By skillfully maintaining the technological process and applying progressive methods, Krivosheykin achieved the roasting of iron pyrite on an average of 225-230 kg/m<sup>2</sup> in 24 hours with a sulfur content in the cinders of not over 1.6%. The concentration of sulfur dioxide varied by not over 0.15%.

All the above enabled Krivosheykin over a period of four months to save 137 tons of pyrite and produce additionally 163 tons of acid over and above the plan -- an amount sufficient to produce 480 tons of superphosphate without any additional expenditures of pyrite.

P. I. Krivosheykin's work experience was adopted by other furnace operators and received widespread application among workers of sulfuric acid plants.

The Ministry of the chemical industry and the TsK of the trade-union of workers of the chemical industry approved Krivosheykin's new approach, and announced an All-Union socialist competition of furnace operators of sulfuric-acid manufactures for increased output of sulfuric acid on the basis of decreased losses of sulfur in the cinders and greater furnace efficiency, and approved the rules for a competition for the title of "Best furnace operator of the sulfuric acid production."

As a result of the application of new working methods in 1954 at the plants of the Glavkhimprom (Glavnoye Upravleniye Khimicheskoy Promyshlennosti -- The Board of the Chemical Industry), over 80 thousand tons of sulfuric acid were produced additionally (as against the 1953 output), which practically amounts to the operation of a completely new sulfuric acid plant.

During 1954-1955, the best results in operating mechanical furnaces were achieved by the brigades of senior furnace operators D. K. Davydkin, N. A. Fedorov, T. M. Il'yin, and G. V. Brikotin, of the Voskresenskiy chemical kombinat.

In 1955 Fedorov's brigade achieved the rate of burning in VKhZ type furnaces of 236.8 kg/m<sup>2</sup> in 24 hours with a sulfur content in the cinders of 2.3%. Even better results were achieved by D. A. Potapov, senior furnace operator of the Vinnitskiy superphosphate plant. The rate of the burning in the VKhZ furnaces attained

237.2 kg/m<sup>2</sup> in 24 hours, with a sulfur content in the cinders of 2.24%.

In the latter part of 1953, a competition for full utilization of new technology methods, multiple-aggregate operation, increased production output, and saving of expensive raw material, was suggested by A. P. Zernova, V. P. Filinova, M. I. Bykova and M. N. Tselikovskaya, operators at the imeni S. M. Kirova plant. These operators, after having studied the work of the process instrumentation and automatic controls installed at the aggregates of synthetic rubber plants, concluded that with modern equipment for the furnaces a greater production output could be achieved, expenditure of expensive raw material (alcohol) reduced, and three aggregates (furnaces) operated by the same number of personnel instead of two furnaces, as against the norm.

Operators Zernova, Filinova, Bykova and Tselikovskaya developed and applied progressive work methods: they increased the supply of air during the regeneration of the catalyst, began to ventilate the chamber of the furnace only after attaining a maximum temperature of the upper part of the retort, learned the start-up procedure at lower temperatures. They paid special attention to the maintenance of the prescribed differentiated density of the condensate, regulating the thermal regime of the furnace by the temperature, of the flow chamber. After starting the operation of the three plant units, they not only did not lower the results of the work, but on the contrary, considerably improved them.

The Ministry of the chemical industry and the TsK of the trade-union of workers of the chemical industry, taking into consideration the great significance of this achievement, decided at that time to organize a socialist competition of operators of contact process furnaces of synthetic rubber plants for full utilization of the new technology on the basis of automation and intensification of production processes, and established conditions for a competition for the title of "Best operator of the synthetic rubber industry."

Entering into a socialist competition in honor of the XXI Congress of the KPSS, A. Shtykh, operator of the Gorlovskiy nitrogen fertilizer plant, appealed to chemical industry operators to open a competition for best utilization of production capacities and increase of production output. A. Shtykh undertook to lower production losses and produce daily 1,280 rub.<sup>1</sup> worth of output over the planned production. I. Gladkiy, operator of the Lisichanskiy chemical kombinat, taking up A. Shtykh's suggestion, undertook to produce 2.2 tons every month over and above the norm. M. Morgun, operator of the Dneprodzerzhinskiy nitrogen fertilizer plant undertook to produce daily not less than 1,400 rub.<sup>1</sup> worth of output over and above the plan.

The operators of V. Mymrykov's brigade (Voronezhskiy zavod SK -- Voronezh Synthetic Rubber Plant) undertook the obligation to save monthly an amount of alcohol required for the manufacture of 72 tires or 3,612 pairs of footwear.

#### Competition for Excellent Performance of the Technological Process

Under the conditions of the chemical production, of prime importance are strict adherence to the established technological regime and to the quality indicators of the work: expenditure coefficients, production output per apparatus, quality of manufactured product. Deviations from the normal technological regime cause great material losses.

Striving to add her part to the nationwide effort for fulfillment of the fifth Five-Year Plan, A. I. Maslova, operator of the Chirchikskiy electro-chemical kombinat, initiated a socialist competition for excellent performance of the technological process and on that basis for additional output of mineral fertilizers.

Working at the synthesis columns, A. I. Maslova took care that the temperature would not exceed the limits established for optimum regime. The interval of the optimum temperatures for the synthesis ( $200^{\circ}$ ) is limited on the potentiometer tape by two red lines. A. I. Maslova tried to achieve a state where the variations of the temperature within this interval would be insignificant; throughout the course of her work the stylus of the recording device registered on the diagram an even course of the technological process, without deviations.

This enabled expert A. I. Maslova to save monthly hundreds of kilowatt-hours of electric power and increase considerably an output of high quality production.

The movement for excellent performance of the technological process shows that with the present technological regulations there exist reserves which permit an increase in equipment capacity, improvement of the economic indicators of the work of enterprises, and assurance of an additional output of production.

#### Competition for the Fulfillment of an Eight-Hour Production Quota in Seven Hours

Inspired by the decision of the XX Congress of the KPSS with regard to gradual change-over to a shortened working day, S. A. Mamontov, calendar operator of the masticating and mixing mill, and F. A. Sidel'tsev, extruding machine operator of the mold shop, both workers of the Kurskiy rubber plant, suggested the organization of a socialist competition for fulfillment of the eight-hour quota in seven hours in all production sections ([Note: Bulletin for exchange of notes on experience in the technical rubber manu-

facturing industry, No. 7, Goskhimizdat, 1958).

After studying thoroughly the production process and mastering the production technology, Mamontov and Sidel'tsev suggested and achieved in practice a number of industrial engineering measures for the work scheduling and production scheduling in their sections, which enabled them to increase considerably the output of the product and assure the fulfillment of an eight-hour quota in seven hours.

Applying the method of continuous rolling of rubber into rolls, S. A. Mamontov eliminated losses during the reloading of calendar rolls. This made possible an increased output of rubber from the calendar by 10%. Working according to this method, the workers of the brigade cut off the rubber not at the rolls at the end of the conveyor, but at its front; at the same time, while the rubber strip moves along the conveyor, the workers have time to load a new roll with cotton fabric. In order to organize continuous compounding of rubber, a third pair of brackets for hanging the cotton fabric was installed on the calendar conveyor where there had previously been two brackets.

Taking into consideration the fact that a calendar brigade produces up to 16 grades (codes) of rubber per shift with various operating temperatures of calendering, and that during change-over from the production of one grade of rubber to another during the heating or cooling period of the calender rolls the equipment remains idle, Mamontov, in order to prevent losses of working time, introduced a definite sequence in the manufacture of the rubber. The output schedule of rubber was prepared by him in such a way that the changeover from high-temperature to low-temperature regime (or vice versa) would be made during the mealtime period.

Strictly adhering to the technological discipline, Mamontov suggested that the speed of calendering of some certain grades of rubber be increased, and the width of the calenderized rubber be also increased, while decreasing waste during its cutting. As a result, the efficiency of the calender for some of the compounded rubber increased by 20-25%.

All workers of Mamontov's brigade were taught two or three skills, which enabled them, when necessary, to perform the duties of other members of the brigade, assuring the continuous work of the calender.

Sidel'tsev, extruding machine operator of the mold shop, also introduced some essential changes into the scheduling of work and production. At the beginning of a shift, Sidel'tsev prepared all the necessary equipment (mandrels, washers, tips) and tools for fulfillment of the various assortments of the day's quota. He toolled the extruding machine once each shift; starting the processing of rubber at low temperature, he consecutively raised the temperature up to 70° (instead of 50° according to the technological chart). By experimenting, Sidel'tsev established that the so-called "over-

heating" of an extruding machine within the range of 50-70° assures a high fluidity of rubber by its better heatup in the chamber. In this manner, working time which was previously spent on cooling of the chamber, was fully utilized for the increase of output of extruded rubber stock.

Sidel'tsev used a water bath with running water to receive the extruded rubber; as a result, standardization was ensured for the stock cut off after extrusion (which in turn eliminated the return of the rubber for reprocessing) and the possibility of scorching the stock was eliminated (which also promoted increased labor productivity).

By applying his working method, Sidel'tsev raised the productivity of the extruding machine by 30%.

The fulfillment at the plant of an eight-hour production quota in seven hours assumed the form of a mass movement, which revealed reserves of product output and labor productivity growth, and assured for the plant a change-over to a seven-hour working day without additional increase of the number of personnel.

The widespread propagation of this movement enabled almost all enterprises of the chemical industry in 1958-1959 to transfer their workers and employees to a shortened working day without added manpower.

## 2. Study and Introduction of Advanced Experience

The effectiveness and economic significance of socialist competition depend mainly on how fast the experience and achievements of peredoviks become adopted by the entire mass of workers and are utilized by them for the growth of labor productivity.

Various methods are applied at enterprises for passing on the experience of the peredoviks. The most widely used methods are those of individual leadership on the part of leading workers over those lagging behind, schools of advanced production experience, verbal and printed propagandizing of progressive experience (publication of special literature, articles in newspapers and magazines, lectures and reports, etc.)

The methods of scientific generalization and widespread introduction of advanced experience were developed by engineer F. L. Kovalev.

The essence of this method is that the best, most rational working methods in individual operations are studied, generalized and propagated among all the workers of a given skill. This makes it possible to apply the most progressive methods, reduce labor expenditure, save on materials and power, and improve the quality of the product.

Of great significance to the chemical industry is the generalization and propagation of progressive methods among all enter-

prises manufacturing similar products, such as, for instance, sulfuric acid, soda, calcium carbide, chlorine, etc. The problem before the operators is to study thoroughly and master the most rational methods of other workers and to pass on their own best methods.

### 3. The Combining of Skills and Multiple-Equipment Use Operation.

The movement to combine skills and transfer to multiple-equipment use operation has assumed widespread proportions at enterprises of the chemical industry. This is connected with ever greater development of technology, mechanization and automation of production processes, and growth of the cultural and technical standards of the workers.

The combining of skills is mainly carried out in the following way:

- 1) combining the main and auxiliary skills (for example, an equipment operator who has learned a metal workers' trade performs the current repairs of the equipment he operates; an equipment operator who has learned how to perform control analyses combines the functions of a laboratory assistant);
- 2) combining the main and associated skills; learning and combining the functions of several operators (for example, a chamber operator who has learned the skill of saturator attendant, assumed the functions of the latter as well; a metal worker on duty also performs the functions of an electrician on duty).

The possibilities of combining various skills exist at most chemical plants. By way of illustration, we adduce some data on the combining of skills at chemical industry plants during various periods of time (Table 20).

The combining of skills promotes a more rational utilization of working time, increase of labor productivity and raise of wages for the group of workers concerned.

Multiple-equipment use operation consists of the simultaneous operation of several pieces of equipment by a single worker or a brigade of workers.

The change-over to operating several pieces of equipment is accomplished at the expense of utilization of a worker's idle time during the time taken by a technological process not requiring any active control.

By developing work scheduling and various operational methods, workers discover possibilities for a further increase of labor productivity and change over to multiple-equipment use operation at their own initiative.

Production expert S. F. Yusypey, because of more expedient work scheduling and saving of time in performance of individual operations, changed over on his own initiative to the operation of five horizontal polymerizers instead of two, as required by the norm. S. F. Yusypey decreases the pressure in the polymerizer in 15 minutes less time than the operators working at adjacent apparatuses, achieving this by warning the operator of the evaporation section ahead of time of the necessity to lower the pressure in the condensers. S. F. Yusypey carried out the discharging and charging of the equipment also in 10-15 minutes less time.

The work methods of S. F. Yusypey, initiator of multiple-equipment use operation, have received widespread adoption beyond the boundaries of the plant at which he works.

Galkin, vacuum-mixer operator, changed over to operating three machines without any assistant, as against a norm of one operator and one assistant to two machines.

The operation of seven presses instead of five as required by the norm was introduced at the Leningrad plant for technical rubber at the initiative of A. V. Zharinova, who achieved considerable reduction of time for raising and lowering the press plates, as well as time for unloading forms; she was able to organize her work properly and achieved an overlapping of the operation time of individual presses.

Z. P. Bozhukha, operator of ammonia synthesis columns at the Dneprozerzhinskiy nitrogen-fertilizer plant, having studied the technological process, applied a method of control which enabled her to change over to the operation of three columns.

Thus, in many sections of production, innovators keep finding new ways and means of increasing labor productivity.

An interesting suggestion was introduced by O. T. Aleshina-Menshikova, milling machine operator and an innovator of the hard rubber shop at the Leningrad plant for technical rubber.

The milling of protectors was made on a standard horizontal milling machine, with special platforms on the work tables equipped with a yoke and an eccentric roll for the clamping of the protector. The milling machine is operated by an individual drive. A push-button control is provided for starting or reversing the machine. The spindle of the milling machine has a set of 68-70 disc mill cutters of the same diameter, between which grommets are inserted.

The milling of the protector involved the following consecutive operations:

1. Putting the protector plates onto the yoke.
2. Starting the motor and clamping the yoke holding the plates by the eccentric roll.
3. Reversing the travel of the work table.

4. Turning the protector plates over on the other side.

The turned-over plates are milled in the same consecutive order of operations.

O. T. Aleshina-Men'shikova perfected the process of milling the protectors:

1. While putting the plates onto the yoke by hand -- the milling machine is idling. Attempting to reduce the idle time of the milling machines, Aleshina-Men'shikova suggested that two plates be taken instead of one and placed consecutively onto the first and second yokes. As a result, the time used for putting 100 plates onto the yokes was reduced from 7.2 to 4.2 min.

2. The yokes with the plates were clamped to the platform of the milling machine by means of the eccentric roll. Aleshina-Men'shikova found that this could be done after starting the milling machine as well, during the approach of the support to the cutters. As a result, this operation took 2.3 min. (100 plates) instead of 3.2 min.

3. After milling one plate on one side, the machine was stopped and the plates turned over for milling on the other side. Aleshina-Men'shikova suggested doing this while the machine was operating; without awaiting its complete stop, she turned the protectors over and reversed the machine. As a result it became possible to turn over 100 plates in 1 min. instead of 2.1 min.

Such a reduction in labor input posed the question of changing over to the operation of three machines instead of one.

However, the position of the milling machines in pairs one after another made difficult the accomplishing of such a measure. Aleshina-Men'shikova then suggested placing the machines differently, and one opposite the other. The diagram of the positioning of the milling machines with the old and new work methods is shown in Fig. 15.

Table 20

## Examples of Combining of Skills

| Section<br>or<br>Shop | Work Performed<br>Prior<br>to com-<br>bining of<br>skills  | Measures assuring<br>possibility of<br>combining skills  |
|-----------------------|--|--|
|                       | a-b-c<br>function<br>performed<br>separately   |  |
| Cleaning<br>section   | <p>a) Turbine pump engi-<br/>nies</p> <p>b) Water scrubber<br/>operator</p>  | <p>Machinist has been taught<br/>operator's skill</p> <p>Machinist<br/>combines<br/>operator's<br/>functions</p>   |
| Sulfuric<br>acid      | <p>a) Assistant<br/>furnace<br/>operator</p> <p>b) Oiler</p> <p>c) Chamber<br/>Attendant</p> <p>d) Saturator<br/>attendant</p> | <p>Assistant<br/>furnace<br/>operator<br/>performs also<br/>functions of<br/>oiler on upper<br/>and middle levels</p> <p>Oiler<br/>performs duties<br/>of chamber<br/>attendant</p> <p>Chamber<br/>attendant<br/>also performs duties<br/>of saturator's<br/>attendant</p> <p>Saturator controls are moved to<br/>chamber attendant's platform,<br/>and chamber attendant has been<br/>taught the work of saturator operator</p> |

|                           |                         |   |  |  |  |
|---------------------------|-------------------------|---|--|--|--|
|                           | a) Tower attendant      | Tower attendant learned the procedure of control analyses and has been taught pump operation. | Machinist has learned metal worker's skill             | Machinist has learned metal worker's skill             | Machinist has learned metal worker's skill             |
|                           | b) Pump attendant       | Maintenance duties are assigned to the metal worker on duty                                   |  |  |  |
|                           | c) Laboratory assistant |   |  |  |  |
| Compressor Section        | a) Machinist            | Machinist also performs duties of metal worker on duty  | Machinist also performs functions of brigade leader    | Machinist also performs functions of brigade leader    | Machinist also performs functions of brigade leader    |
|                           | b) Metal Worker         |   |  |  |  |
|                           | c) Laboratory assistant |   |  |  |  |
| Battery cells manufacture | a) Press-brigade leader | Metal worker also performs functions of brigade leader  | Metal worker also performs functions of brigade leader | Metal worker also performs functions of brigade leader | Metal worker also performs functions of brigade leader |
|                           | b) metal worker         |   |  |  |  |
| Milling                   | a) Set-up man           | Set up man combines the functions of metal worker   | Set up man combines the functions of metal worker      | Set up man combines the functions of metal worker      | Set up man combines the functions of metal worker      |
|                           | b) Metal worker         |   |  |  |  |
| Parts                     | a) Storekeeper          | Storekeeper combines the functions of tool man  | Storekeeper combines the functions of tool man         | Storekeeper combines the functions of tool man         | Storekeeper combines the functions of tool man         |
|                           | b) Tool man             |   |  |  |  |
| Textolite                 | a) Machinist            | Machinist combines the functions of oiler   | Machinist combines the functions of oiler              | Machinist combines the functions of oiler              | Machinist combines the functions of oiler              |
|                           | b) Oilier               |   |  |  |  |

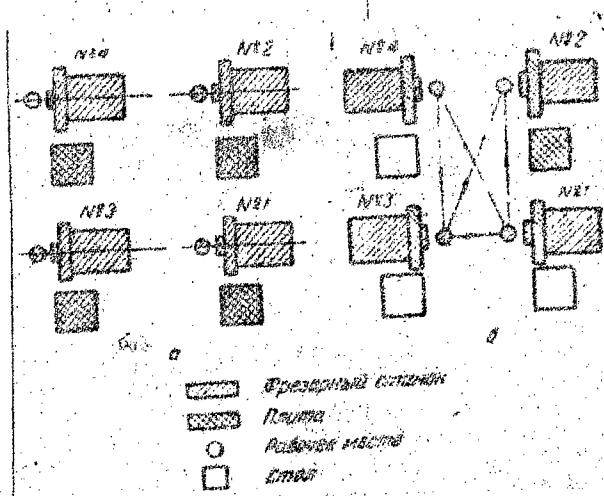


Fig. 15. The positioning of the milling machines:

a - with the old method

b - with the new method.

Legend:      A. Milling Machine  
                  B. Work table  
                  C. Work place  
                  D. Table

The milling machines were placed in pairs, one opposite the other, so that the work was carried out on three milling machines; the fourth machine was kept as a stand-by -- in case of one of the working machines being put out of order. Subsequently, a change-over to operation of four milling machines was accomplished.

The measures adopted made it possible to increase the production output of a milling machine. Previously, with the old method (on two machines), the output from one machine amounted on an average to 390-400 protectors. With the new working method the output of each milling machine was increased up to 480-500 protectors.

After change-over of the hard rubber shop to multiple-equipment use operation, the personnel of the section was reduced by one half.

Preparation for the XXI Congress of the Party, the work of the Congress and the resolutions adopted by it, created an extraordinary upsurge of labor and political activity among the people. At the initiative of the komsomol and other youth groups, a movement was begun for the creation of brigades of communistic labor (workers), which spread throughout the entire country with amazing speed.

The duties of communist labor brigades were directed first of all toward a steady raise of labor productivity, learning of newest technique, advanced technology, knowledge, and professional skill. Member of brigades are bound to help one another in studies, in acquiring cultural wealth; to adhere strictly to the socialist moral code, and together to fight against the survivals of the past.

From the heroes of the first subbotniki, who by incredible effort, had with their own hands lifted the country out of a state of collapse, from the shock brigades of the first Five-Year Plans, who had with self-sacrifice laid the foundations for Soviet industry, the glorious cause was now relayed to brigades of communist workers created on foundations of modern industry and great achievements of science and technology. These brigades are a vivid expression of the new traits of man freed from exploitation, who experience the joy of building through creative work for society. The movement for the creation of communist labor brigades -- highest form of socialist competition -- has a great future as a powerful means for the education of working people in the spirit of communism, for further cultural and technical growth of the working class, and rapid achievement of the highest factors of labor productivity.

The young communist brigade of N. Pudovkin, which works on construction at the Kuybyshev synthetic rubber plant, suggested a communist competition for the realization of a new Seven-Year Plan.

The youth collective of one of the shops of the Lisichanskiy chemical kombinat proclaimed themselves to be a communist-labor shop, and assumed an obligation to achieve in 1960 the level of labor productivity scheduled for 1965, to produce an output of 58 thousand tons over and above the plan for seven years, and to add

15 million rub. to the komsomol savings bank.

At the Moscow tire plant, a komsomol-youth communist-labor shift assumed the obligation to fulfill the seven-year program in 6.5 years, to raise labor productivity by 40%, and to achieve a saving in supply expenses of 1 million rub.

The Communist Party and the Soviet Government head the socialist competition of the wide masses of working people, and render them every assistance. At present socialist competition constitutes for the main part an effort to fulfill and overfulfill the Seven-Year Plan, to raise in every possible way the quality and reduce the cost of production, to save on raw materials and supplies, to utilize properly industry's internal reserves, to introduce new technique and progressive technology, to further raise labor productivity and production culture.

The XII Congress of trade unions pointed out that trade-union organizations, announcing socialist competition for fulfillment of the Seven-Year Plan ahead of time, must take into consideration the definite conditions of individual branches of the national economy and direct the production activity and the creative initiative of the working people toward the solution of the most essential problems facing a given branch of the national economy. In the chemical industry, every attention should be directed toward rapid development of chemical production, especially of artificial and synthetic fibers, thermosetting plastics, and other synthetic materials, rapid mastering of new production capacities, perfection of technological processes, increased output of finished products, substitution of expensive raw materials with less expensive ones, and better utilization of production wastes.

Workers of enterprises assume the obligation to fulfill ahead of time the quotas of the Seven-Year Plan for the production level, without increasing the planned capital investment either for the entire period, or for the individual years of the Seven-Year Plan.

At the opening of the exposition of achievements of the national economy of the USSR, N. S. Khrushchev pointed out that only through reconstruction of enterprises, introduction of advanced technological processes, substitution of obsolete equipment and other production reserves, could it be possible to increase the capacities as against the quotas according to the Seven-Year Plan within the following extents [Note:] "Pravda" of 17 June 1959: for thermosetting plastics and resins -- by 200 thou. tons; for synthetic rubber -- by 130 thous. tons, which corresponds to the building of another new large size plant; for mineral fertilizers -- by 3 million 300 thou. tons; for automobile tires -- by 4 million 500 thou. pieces.

The TsK KPSS, in their resolution of 17 June 1959 approved the initiative of the Gor'kovskiy obkom of the KPSS and of the Sovnar-khoz to attain for the chemical industry the production level programmed for the end of the Seven-Year Plan, in 1964, by the 47th

anniversary of the Great October Socialist Revolution. In 1965 the chemical and oil-refining plants of the Gor'kovskiy economic rayon will produce a gross output of 1 billion 100 million rub. over and above the quotas of the Seven-Year Plan.

This valuable example was taken up in many other economic rayons.

Of great importance to the fulfillment of the Seven-Year Plan ahead of time are the decisions of the June (1959) Plenary Session of the TsK KPSS. The Plenary Session established definite problems for the introduction of complex mechanization, automation of production, introduction of production lines, substitution of obsolete equipment, raising the quality of production output and lowering of cost.

The plenary Session of the Central Committee of the Party, addressing all the working people of the Soviet Union, appealed for further development of nationwide socialist competition for the fulfillment of the Seven-Year Plan ahead of time.

The appeal points out that "The Plenary Session believes that the fulfillment and overfulfillment of the Seven-Year Plan is the most important problem of our time. It is a decisive step for our Country on the road to communism."

Developing and supporting the creative initiative and activity of workers, engineers, and technologists in discovering production reserves, economic organs should, together with trade-union organizations, create conditions for the utilization of such reserves by workers, toward a fulfillment of socialist obligations.

Socialist competition promotes the successful building of communism in the USSR.

## Chapter Ten

### PRODUCTION COST AND WAYS TO LOWER IT

#### 1. Production Cost

The cost of industrial production represents the expression in money of an enterprise's expenditures thereon. The cost of production is the most important indicator of the quality of the entire work of an enterprise. With systematic lowering of production cost, the State obtains additional means for a further development of social production and for elevation of the material well-being of the working people. With exceedingly great scope of production, the lowering of cost even by one percent produces a saving amounting to billions of rubles.

At the end of the first Five-Year Plan, the lowering of production cost by 1% a year assured an economy of 150-200 million rub. In 1950 the saving amounted to 4 billion rub., in 1955 -- to

over 6 billion rub., in 1956 -- to over 7 billion rub. In future a 1% lowering of production cost in manufacturing and in transporting of freight should produce a saving of over 10 billion rub.

Industry in the USSR shows considerable success in the lowering of production costs. The yearly average percentage of lowering of cost has steadily increased with each new Five-Year Plan.

Control figures for the development of the national economy of the USSR for 1959-1965 provide for lowering of industrial production cost at comparable prices by not less than 11.5%.

In order to participate in the effort toward lowering of production cost, every worker of a socialist enterprise should know what it comprises.

Lowering of production cost  
(in %) for the entire period  
on an average per year

|           |      |      |
|-----------|------|------|
| 1928-1932 | 9.2  | 1.84 |
| 1933-1937 | 10.3 | 2.06 |
| 1946-1950 | 17.0 | 3.40 |
| 1951-1955 | 23.0 | 4.60 |

The production cost at a socialist enterprise is composed of the following elements of expenditures:

- 1) Raw materials and basic supplies.
- 2) Auxiliary supplies.
- 3) Fuel from outside sources.
- 4) Power from outside sources.
- 5) Amortization of the main assets (depreciation of the cost of building, structures, machines, equipment, transport facilities, etc.)
- 6) Wages paid to workers, engineering and technical personnel, and other employees.
- 7) Deductions for social insurance.
- 8) Other cash outlays.

The ratio of the separate elements of production cost (in %) to the combined amount of expenditures represents the structure of the production cost.

Industrial production cost does not include expenses for capital building, for social and cultural needs, and All-State expenses (for the maintenance of the Government apparatus, increase of material reserves, etc.).

The structure of expenses for industrial production in various branches of industry varies, and depends on specific peculiarities of each branch (Table 21).

Table 21

Structure of expenditures for the Production of Industrial Manufacture for 1955

(in % of the total expenditures)

|                             | Raw mate-<br>rials<br>and<br>supplies | Fuel<br>and<br>power | Wages<br>after<br>deduction<br>from<br>out-<br>side<br>sources | Amorti-<br>zation<br>for social<br>insurance | Other<br>cash<br>outlays | Total<br>expen-<br>ditures |
|-----------------------------|---------------------------------------|----------------------|--|--|--------------------------|----------------------------|
| Entire<br>industry          | 66.8                                  | 6.0                  | 20.9   | 3.3  | 3.0                      | 100.0                      |
| including:                  |                                       |                      |  |  |                          |                            |
| Coal<br>mining              | 17.6                                  | 3.9                  | 64.1   | 6.3  | 8.1                      | 100.0                      |
| Machine<br>tool<br>building | 54.3                                  | 4.7                  | 33.2   | 4.1  | 3.7                      | 100.0                      |
| Chemical                    | 69.0                                  | 10.0                 | 14.3   | 3.5  | 3.2                      | 100.0                      |
| Basic<br>chemistry          | 60.0                                  | 8.2                  | 21.8   | 5.0  | 5.0                      | 100.0                      |
| Soda                        | 21.5                                  | 30.0                 | 33.5   | 8.0  | 7.0                      | 100.0                      |

|                 |      |      |      |      |     |       |
|-----------------|------|------|------|------|-----|-------|
| Nitrogen        | 30.2 | 30.0 | 22.0 | 10.8 | 7.0 | 100.0 |
| Aniline-dye     | 65   | 7.6  | 17.5 | 3.9  | 6.0 | 100.0 |
| Lacquer & paint | 85.3 | 2.6  | 8.7  | 1.1  | 2.3 | 100.0 |
| Tire            | 88.7 | 2.4  | 6.5  | 1.2  | 1.2 | 100.0 |

From Table 21 it may be seen that in the chemical industry expenses on raw materials, fuel and power have the greatest specific weight. However, the structure of expenses in separate branches of the chemical industry depends also on their technological peculiarities, and, therefore, varies.

Thus, in the soda and nitrogen industry, which involve electrolytic processes requiring considerable power demands, much specific weight is taken up by power expenditures, and in the lacquers and paints or tire industry the greatest expenses are related to the acquisition of raw materials due to their high cost (rubber, alcohol, etc.).

From the structure of expenditures adduced above, arise the main problems connected with the lowering of expenses in the individual branches of industry.

The attention of workers of the chemical industry should first be directed toward reduction of expenditures of raw materials, fuel and power, which take up considerable specific weight within the total production expenses.

When preparing plans for an enterprise, provision is made for minimum expenditures necessary for the estimated production volume and assortment. Expressed in money, these expenditures comprise the estimated industrial production cost.

Actually, production cost may deviate from that estimated. The difference between the estimated and actual cost is the indicator of the successful function of an enterprise.

## 2. Production Cost Estimate.

The planning and accounting of industrial production cost provides not only the determination of the combined amount of expenditures for the enterprise, but also the establishment of the production cost for each type of product manufactured.

The calculation of the cost of separate types of production is called cost estimating. There are planned and final cost estimates.

In compiling the planned cost estimates it is necessary to work on the basis of the estimated production volume and estimated expenditure norms for raw materials, supplies, fuel, and power, and the estimated wage fund. Planned cost estimates should reflect any proposed measures for better utilization of supplies, fuel and power, increase of labor productivity, and introduction of advanced work methods, as well as other measures.

Final cost estimates are compiled on the basis of the data of bookkeeping reports of expenditures actually made.

By comparing the final and planned cost estimates, the fulfillment of the plan for production cost is controlled and an evaluation of the work of the shops is carried out.

Expenses included in the planned and final cost estimates are subdivided into the main, or production expenses, and production operating and administrative expenses.

The main, or production, expenses include those for raw materials, basic supplies, fuel for technical purposes, electric power, steam, and other types of power for technological purposes, as well as wages and salaries, and amortization.

Expenditures for the operation and management of individual shops are called shop expenses; expenditures for the operation and management of an enterprise as a whole are called general plant expenses.

As an example, an estimate of the cost of production of sulfuric acid is adduced below (Table 22).

Table 22

Planned cost Estimate of Sulfuric Acid Manufacture by the Chamber Process ([Note: Figures are arbitrary])

Output according to the 1959 plan -- 50,000 tons

| Expenditures                                     | Expenditure for one ton of acid             |                     |                    |
|--|---|---------------------|--------------------|
|  | Amount of<br>raw mate-<br>rial and<br>power | Price<br>in<br>rub. | Cost<br>in<br>rub. |
| <b>I. Raw materials and basic supplies, tons</b> |   |                     |                    |
| pyrite, 45%                                      | 0.8   | 150                 | 120                |
| melange 100%                                     | 0.02  | 700                 | 14                 |
| <b>Total for item I</b>                          |   |                     | <b>134</b>         |

|  |       |      |        |
|--|-------|------|--------|
| II. Technical<br>fuel<br>(7,000 cal),<br>tons      | 0.005 | 140  | 0.70   |
| III. Power expenditures<br>electric power,<br>kwhr | 40    | 0.20 | 8      |
| water, m <sup>3</sup>                              | 30    | 0.08 | 2.40   |
| Total for item III                                 |       |      | 10.40  |
| IV. Wages of production<br>workers                 |       | 10   |        |
| V. Amortization                                    |       | 5    |        |
| VI. Shop expenses                                  |       | 14   |        |
| VII. General plant expenses                        |       | 9    |        |
| Plant production cost                              |       |      | 183.10 |

Cost estimates show what expenses compose the cost of a product, and their specific weight in the total expenditures.

### 3. Ways of Lowering the Production Cost

Production cost depends primarily on labor productivity.

An increase in labor productivity, expressed in larger production volume per unit of time by the same workers, promotes a decrease of a portion of the operating and administrative expenses of the production per unit of production; as a result, the production cost of every ton of product is lowered.

Example: Let us assume that as a result of the operators' mastering some advanced working methods and improved performance of the technological process, the output of sulfuric acid, owing to increased labor productivity, has been raised 10%, and instead of 1,000 tons as provided for by the production plan now amounts to 1,100 tons. In such a case the production cost of the acid will amount to [Note: Figures are arbitrary]:

With an output of sulfuric acid, in tons, of

| Elements<br>of<br>Cost  | Cost of<br>one ton<br>rub. | Cost of<br>1,000<br>tons<br>rub. | Cost of<br>1,100 tons<br>rub. | Cost of<br>one ton<br>rub. |
|---|----------------------------|----------------------------------|-------------------------------|----------------------------|
|   | 1,000                      |                                  | 1,100                         |                            |
| 1. Production<br>expenses                                       |                            |                                  |                               |                            |
| a) Cost of<br>raw materials<br>and supplies                     | 144                        | 144,000                          | 158,400                       | 144                        |
| b) Wages  | 11                         | 11,000                           | 12,100                        | 11                         |
| c) Amortization   | 5                          | 5,000                            | 5,500                         | 5                          |
| 2. Operating and<br>Administrative<br>Expenses of<br>Production |                            |                                  |                               |                            |
| a) Shop   | 14                         | 14,000                           | 14,000                        | 12.73                      |
| b) General plant  | 9                          | 9,000                            | 9,000                         | 8.18                       |
| Total   | 183                        | 183,000                          | 199,000                       | 180.91                     |

It is evident from the Table that with an increase in production output owing to a 10% increase in labor productivity, the cost of 1 ton of production was lowered by 1.2% as a result of the decreased portion of expenses for operating and administration of production.

Thus, every worker who achieves increased labor productivity helps lower the production cost. In the production cost of the chemical industry much specific weight is taken up by the cost of raw materials, supplies, fuel and electric power. Therefore, a reduction of losses and wastes of raw materials and supplies, increased output of intermediates and finished products, constitute important ways of lowering the cost of a unit of production. In the rubber industry an important role is played by the reduction of the amount of wastes in the cutting of materials and by care exercised with

regard to finished parts of footwear; in synthetic rubber manufacture --increased output of divinyl, in sulfuric acid production --lowered losses of sulfur, in the production of calcium carbide - economy of electric power, etc.

Example 1: Let us assume that as a result of reduced losses of sulfur in cinders the ratio of pyrite was lowered by 0.05 tons (from 0.8 tons to 0.75 tons). The cost of one ton of pyrite is 150 rub. With such conditions the cost of one ton of sulfuric acid will be lowered by 7 rub. 50 kop. (150 x 0.05).

For a plant producing 200 tons of sulfuric acid in 24 hours, such a reduction of the pyrite ratio assures a saving of 1,500 rub. (200 x 7 rub. 50 kop.) per day, 45,000 per month, and 540,000 per year.

Example 2: In the production of calcium carbide, as a result of proper performance of the technological process, the rate of electric power for one ton was reduced by 100 kwhr. The cost of one kwhr of electric power is 3 kop. Consequently, the production cost of one ton of calcium carbide will thereby be lowered by 3 rub. With a monthly output of 30,000 tons of carbide, a saving of 90,000 rub. will be attained.

The achievements of Samoylov and Karpukhin, Maslova, Krivosheykin; and other innovators of the chemical industry ([Note:] See Chapter ten) in saving raw materials, reduction of wastes and increased production output confirm the possibility of considerably lowering production cost.

Striving toward better utilization of raw materials and supplies, one should not forget the necessity for improvement of the quality and external finish of the product.

By improving the quality of the products, workers actually participate in lowering of production cost.

An important part in the lowering of the cost is played by improvement of the production technology, application of new, more economical supplies and equal substitutes. Thus, as a result of the adoption by the Krasnyy Khimik (Red Chemist) plant of a new method of production of reactive sulfuric acid directly from gas, the expenditure of sulfuric acid was lowered by 50 kg and the necessity for use of fuel was eliminated. All this lowered the production cost of one ton of reactive sulfuric acid by 30%. As a result of a change in the technology of obtaining anhydrous sodium sulphate, the labor input required for this process was reduced 1.7 times; improved technology in the production of silicon dioxide made it possible to reduce the labor input required 1.9 times. As a result of substitution (at the same plant) of a production of potash

with technical caustic potash, a saving of 41 thou. rub. a year was achieved. The return of washout water into production for the utilization of the sulfur remaining therein produces an annual saving of 39.2 thou. rub.

Considerable help in the development of present technological processes, in learning the use of new types of supplies and utilization of wastes, is rendered by complex brigades created at enterprises, consisting of workers of the plant laboratories and shops (technologists, mechanics, electricians) and of worker-innovators.

At many enterprises general inspections of the state of production are carried out systematically, followed by solicitation for suggested innovations aimed at lowering the production cost.

Increased production output from currently working equipment in production areas and better utilization of equipment in time promote the lowering of production cost.

The most essential conditions for the fullest utilization of equipment in time are: shortening of idle-time periods for equipment being repaired and increasing the working time of equipment between repairs. Repair workers should assure timely and high-quality maintenance repairs, and provide better care of equipment.

A further lowering of industrial production cost may be attained also by innovations in production management, reduction of the administrative personnel and lowering operating expenses.

Considerable expenditures in the chemical industry are made for maintenance repairs of the main facilities and on wages for shop personnel. Yet a saving may be attained in expenditures for maintenance repairs without loss in quality of the repairs.

At many chemical production enterprises considerable corrosion of equipment leads to its rapid deterioration and need for expensive repairs. In order to lower repair expenses, collectives at progressive enterprises of the chemical industry are carrying out widespread introduction of anticorrosive materials, which prolong the useful life of the equipment.

Thus, at an isopropyl-alcohol shop of a certain plant, instead of diabase, another anticorrosive material (ATM on an "Arsamite" base) was applied for the lining of hydrolyzers, which extended the useful life of a hydrolyzer six times and reduced repair expenses by 160 thou. rub. a year. As a result of the substitution of diabase with another material in 1955-1956 the expenses for supplies were lowered by 566 thou. rub. ([Note] I. A. Belen'kiy -- "Industrial Production Cost and Ways to Lower it at an Industrial Enterprise." Dzerzhinsk, 1957].

A considerable reserve possibility for lowering expenses on maintenance repairs lies in the reducing of the number of repair workers. This may be achieved by centralization of the repair services, mechanization of labor intensive work and widespread specialization in repairs.

At enterprises of the chemical industry the centralization of repair services is carried out very slowly, and, as a rule, every workshop has a considerable number of repair and other auxiliary workers.

To reduce the number of repair personnel and lower repair expenses in shops, it is advisable to keep within the shifts repair workers for simple repairs only, and to carry out equipment repairs by means of well-equipped auxiliary shops with larger personnel.

A considerable increase in repair work expenses is caused at many enterprises by handmade manufacture of some certain repair supplies (gaskets, bolts, nuts, etc), whereas these materials should be supplied in sufficient quantities by specialized enterprises at relatively low prices.

Shop expenses may also be lowered by reducing the wages of the entire shop personnel. For that purpose, measures for the simplification of the shop management structure should constantly be carried out. Widespread introduction of machine accounting is of great significance in lowering the above expenses.

A substantial effect on the reduction of expenditures for wages of shop personnel may be produced by the wide adoption of automation of production control and release of a considerable number of laboratory assistants. A certain enterprise, for example, had one laboratory assistant to each four production workers. On frequent occasions analyses being conducted were duplicated in different shops or in the technical control department.

To reduce the number of personnel engaged in production control, the enterprise stopped duplicating analyses of finished products at shop laboratories and at the technical control department. Control of the finished products is now being carried out only in the shops under the supervision and with control sampling by the OTK. As a result of this measure, 35 laboratory assistants and seven engineering and technical workers were released, with an annual wage fund of 400 thou. rub; at the same time the responsibility of the shop personnel for the quality of the production output was raised.

Wide masses of workers are taking active part in the effort to lower production cost at socialist enterprises. New forms of socialist competition for the lowering of production cost originated in industry in the post-war period.

For greater effectiveness of a competition, all workers should study thoroughly problems of the origination and development of production costs, and ways for their reduction.

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